

# SINGLE STAGE EXPERIMENTAL EVALUATION OF VARIABLE GEOMETRY GUIDE VANES AND STATOR BLADING

PART V - OVERALL PERFORMANCE FOR VARIABLE  
CAMBER GUIDE VANE AND STATOR B WITH RADIAL  
AND CIRCUMFERENTIAL INLET FLOW DISTORTION

BY

B. A. JONES, R. P. OSCARSON, AND C. E. CLARK

Prepared For  
National Aeronautics and Space Administration

Contract NAS3-7604

N 69-19804		(THRU)	1
(ACCESSION NUMBER)		(CODE)	
93		(PAGES)	
NASA-CR-54558		(CATEGORY)	28
(NASA CR OR TMX OR AD NUMBER)			

FACILITY FORM 602

**Pratt & Whitney Aircraft**  
FLORIDA RESEARCH AND DEVELOPMENT CENTER  
BOX 2691, WEST PALM BEACH, FLORIDA 33402

DIVISION OF UNITED AIRCRAFT CORPORATION

**U  
A®**

REPRODUCED BY  
NATIONAL TECHNICAL  
INFORMATION SERVICE  
U. S. DEPARTMENT OF COMMERCE  
SPRINGFIELD, VA. 22161

## NOTICE

This report was prepared as an account of Government-sponsored work. Neither the United States, nor the National Aeronautics and Space Administration (NASA), nor any person acting on behalf of NASA:

- A.) Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or
- B.) Assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method, or process disclosed in this report.

As used above, "person acting on behalf of NASA" includes any employee or contractor of NASA, or employee of such contractor, to the extent that such employee or contractor of NASA or employee of such contractor prepares, disseminates, or provides access to any information pursuant to his employment or contract with NASA, or his employment with such contractor.

Requests for copies of this report should be referred to:

National Aeronautics and Space Administration  
Scientific and Technical Information Facility  
P.O. Box 33  
College Park, Md. 20740

# N O T I C E

THIS DOCUMENT HAS BEEN REPRODUCED FROM  
THE BEST COPY FURNISHED US BY THE SPONSORING  
AGENCY. ALTHOUGH IT IS RECOGNIZED THAT CER-  
TAIN PORTIONS ARE ILLEGIBLE, IT IS BEING RE-  
LEASED IN THE INTEREST OF MAKING AVAILABLE  
AS MUCH INFORMATION AS POSSIBLE.

**SINGLE STAGE EXPERIMENTAL EVALUATION  
OF  
VARIABLE GEOMETRY GUIDE VANES  
AND STATOR BLADING**

**PART V - OVERALL PERFORMANCE FOR VARIABLE  
CAMBER GUIDE VANE AND STATOR B WITH RADIAL  
AND CIRCUMFERENTIAL INLET FLOW DISTORTION**

**BY**

**B. A. JONES, R. P. OSCARSON, AND C. E. CLARK**

**Prepared For  
National Aeronautics and Space Administration  
31 DECEMBER 1968  
Contract NAS3-7604**

**Technical Management  
NASA Lewis Research Center  
Cleveland, Ohio**

**NASA Program Manager: James J. Watt  
Air Breathing Engines Division**

**NASA Research Advisor: L. Joseph Herrig  
Fluid Systems Components Division**

**Pratt & Whitney Aircraft**  
**FLORIDA RESEARCH AND DEVELOPMENT CENTER**

**BOX 2691, WEST PALM BEACH, FLORIDA 33402**

**U  
A<sup>®</sup>**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**

SINGLE STAGE EXPERIMENTAL  
EVALUATION OF VARIABLE  
GEOMETRY GUIDE VANES  
AND STATOR BLADING

PART V - OVERALL PERFORMANCE FOR VARIABLE  
CAMBER GUIDE VANE AND STATOR B WITH RADIAL  
AND CIRCUMFERENTIAL INLET FLOW DISTORTION

B. A. JONES, R. P. OSCARSON, AND C. E. CLARK

PRATT & WHITNEY AIRCRAFT  
FLORIDA RESEARCH AND DEVELOPMENT CENTER

SUMMARY

A single stage experimental investigation of a variable camber inlet guide vane, rotor, and variable geometry stator was conducted to determine the influence of radial and circumferential inlet flow distortion on the stage overall performance characteristics and stall margin. Tests were conducted with two settings of the variable camber guide vane, referred to as sea level takeoff (SLTO) and cruise configurations. Both configurations were tested at 70, 80, and 100% of the SLTO design equivalent rotor speed. The 70% speed condition was the design cruise rotor speed and corresponds to a supersonic flight Mach number of approximately three.

The stage had a hub/tip ratio of approximately 0.5 and a tip diameter of approximately 43 inches, and in general resembled the front stage of a compressor for a high cruise flight Mach number engine. The variable geometry guide vane was designed with 63-Series airfoils and comprised a fixed forward segment and two articulated flaps. The rotor was designed with circular arc airfoils and had a tip inlet relative Mach number of 1.15. The variable geometry stator was designed with 65-Series airfoils and comprised two adjustable segments that permitted variation of the leading and trailing edge metal angles.

When operating at SLTO design rotor speed in the SLTO configuration, the radial and circumferential distortion resulted in 29 and 40% reductions in stall margin, respectively. At cruise rotor speed with radial distortion the stall margin for the cruise configuration was 16.5% greater

than that for the SLTO configuration with distortion. The stall margin of the cruise configuration at cruise rotor speed with circumferential distortion was 19% greater than that for the SLTO configuration with distortion. The circumferential distortion caused a slightly greater loss in stage efficiency than the radial distortion.

## INTRODUCTION

The decrease in compressor inlet flow and, hence, axial velocity between the sea level takeoff (SLTO) design point and the cruise design point of high flight Mach number turbojet engines imposes a wide incidence angle operating range requirement on the compressor front stage rotor. Distortion of the compressor inlet flow can result from aircraft/engine inlet flow nonuniformities and/or flow instabilities. Distortion will result in further reduction in local inlet axial velocity and, consequently, further increase in local incidence angle to levels that may result in significant loss in compressor efficiency and stall margin.

An experimental investigation was conducted with a single stage compressor to evaluate the extent that variable geometry concepts for inlet guide vanes and stators can be applied to provide adjustment of the blade section velocity triangles and thereby increase the stable operating range of compressor front stages. A variable camber inlet guide vane, rotor, and two variable-geometry stator configurations (designated Stator A and Stator B) were designed, fabricated, and tested with uniform inlet flow over a range of equivalent rotor speeds from 50 to 110% of the SLTO design rotor speed. Overall and blade element performance data for the undistorted inlet flow tests of the Stator A and Stator B stages are presented in References 2 and 3, respectively. The stage with Stator B was selected for subsequent overall performance tests with (1) circumferentially distorted inlet flow generated by means of a 90-degree sector distortion screen and (2) radially distorted inlet flow generated by means of a 360-degree radial distortion screen that covered 40% of the outer annulus area. The distortion screen porosity was selected to provide a total pressure drop of 7% at a stage inlet Mach number of 0.42. Tests with the two distorted inlet flow conditions were conducted with

two settings of the variable camber guide vane and variable geometry stator blading referred to as SLTO and cruise configurations. The cruise rotative speed was selected as 70% of the SLTO value and corresponds to a supersonic flight Mach number of approximately three.

Details of the aerodynamic and mechanical design of the stage blading and compressor rig are presented in Reference 1. This report presents the overall performance results obtained with the Stator B stage operating with circumferential and radial inlet flow distortion.

## TEST EQUIPMENT

### Facility

Details of the compressor research facility, test rig, blading design, and instrumentation for the tests with undistorted inlet flow are presented in References 1 and 3. A description of the test equipment particular to the distorted inlet flow test program is presented below.

### Variable-Geometry Stage Description

A sketch of the variable-geometry stage is shown in figure 1 and pertinent flowpath dimensions are shown in figure 2.

Two design settings of the variable camber inlet guide vane and variable-geometry stator blading are referred to as sea level takeoff (SLTO) and cruise configurations. The SLTO configuration was designed to provide axial inlet flow (zero rotor prewhirl) at the exit of the inlet guide vane and near-axial stator exit flow. The cruise configuration was designed to provide 35-degree hub/20-degree tip rotor prewhirl and 30-degree hub/25-degree tip stator exit air angle distribution. The variable camber guide vane comprised a fixed leading edge segment and two articulated flap segments. The variable-geometry stator had adjustable leading and trailing edge metal angles by virtue of two variable-chord-angle segments. Photographs and section views of the guide vane and stator are shown in figure 3 to illustrate the SLTO and cruise configurations. Geometry details of the variable-camber inlet guide vane, rotor, and Stator B are summarized in table 1a, 1b, and 1c. Symbols and performance variables are defined in Appendix A.

Table 1. Design Data

## a. Inlet Guide Vane Geometry

Airfoil Series: 63  
 No. of Blades: 20  
 Aspect Ratio: 2.642  
 Thickness Ratio: 0.09

SLTO Configuration

Percent Span (from tip)	$\kappa_1$	$\kappa_2$	$\phi$	$\gamma^\circ$	c	$\sigma$	$\delta^\circ$
90	-20.2	5.4	25.6	1.2	4.55	1.412	Approximately 1.0 Degree Estimated
70	-20.2	3.7	23.9	0.5	4.55	1.245	
50	-20.2	1.9	22.1	-0.2	4.55	1.080	
30	-20.2	0.3	20.5	-0.9	4.55	0.913	
10	-20.2	-1.6	18.6	-1.6	4.55	0.748	

Cruise Configuration

Percent Span (from tip)	$\kappa_1$	$\kappa_2$	$\phi$	$\gamma^\circ$	c	$\sigma$	$\delta^\circ$
90	-20.2	36.0	56.2	21.1	4.47	1.412	2.2
70	-20.2	34.3	54.5	20.5	4.47	1.245	3.2
50	-20.2	32.5	52.7	19.9	4.47	1.080	4.3
30	-20.2	30.9	51.1	19.2	4.47	0.913	5.9
10	-20.2	29.0	49.2	18.5	4.47	0.748	7.1



Table 1. Design Data (Continued)

## b. Rotor Geometry

Airfoil Series: Circular Arc  
 No. of Blades: 34  
 Aspect Ratio: 2.829

SLTO Configuration

Percent Span (from tip)	$\kappa_1$	$\kappa_2$	$\phi$	$\gamma^\circ$	$i_m$	$c$	$\sigma$	$t/c$	$\delta$	$\bar{\omega}'$
90	48.6	18.8	29.8	31.2	1.4	3.24	1.42	0.0744	6.1	0.024
70	52.5	32.5	20.0	41.2	1.4	3.43	1.30	0.0641	4.3	0.024
50	56.1	42.1	14.0	48.2	1.2	3.63	1.20	0.0542	3.8	0.033
30	59.6	48.6	11.0	53.6	0.4	3.82	1.12	0.0445	3.3	0.058
10	63.2	52.9	10.3	57.9	0.0	4.01	1.06	0.0355	3.8	0.097

Cruise Configuration

Percent Span (from tip)	$\kappa_1$	$\kappa_2$	$\phi$	$\gamma^\circ$	$i_m$	$c$	$\sigma$	$t/c$	$\delta$	$\bar{\omega}'$
90	Same as SLTO Configuration				-1.7	Same as SLTO Configuration			6.2	0.030
70	Same as SLTO Configuration				2.3	Same as SLTO Configuration			4.3	0.018
50	Same as SLTO Configuration				4.3	Same as SLTO Configuration			2.9	0.030
30	Same as SLTO Configuration				4.9	Same as SLTO Configuration			2.3	0.064
10	Same as SLTO Configuration				4.5	Same as SLTO Configuration			2.5	0.125

Table 1. Design Data (Continued)

## c. Stator B Geometry

Airfoil Series: 65  
 No. of Blades: 40  
 Aspect Ratio: 2.939  
 Thickness Ratio: 0.08

SLTO Configuration

Percent Span (from tip)	$K_1$	$K_2$	$\phi$	$\gamma^\circ$	$i_m$	$c$	$\sigma$	$\delta^\circ$	$\bar{\omega}$
90	40.9	-8.7	49.6	16.0	-4.2	2.75	1.28	12.8	0.026
70	37.1	-7.5	44.6	14.5	-3.3	2.88	1.19	10.1	0.025
50	34.7	-7.5	42.2	13.5	-3.2	3.00	1.12	9.3	0.026
30	34.0	-8.0	42.0	13.2	-3.2	3.13	1.07	9.8	0.029
10	36.0	-8.9	44.9	13.5	-4.8	3.27	1.02	11.0	0.032

Cruise Configuration

Percent Span (from tip)	$K_1$	$K_2$	$\phi$	$\gamma^\circ$	$i_m$	$c$	$\sigma$	$\delta^\circ$	$\bar{\omega}$
90	49.9	17.3	----	----	-2.2	----	1.28	11.9	0.040
70	46.1	18.5	----	----	1.7	----	1.19	9.0	0.038
50	43.7	18.5	----	----	3.2	----	1.12	8.2	0.030
30	43.0	18.0	----	----	3.2	----	1.07	8.4	0.024
10	45.0	17.1	----	----	1.2	----	1.02	9.3	0.027

### Distortion Screens

Two distortion screens were designed and fabricated for these tests: one 90-degree sector screen for circumferential distortion of the inlet flow, and one 360-degree screen that covered the outer 40% annulus area for radial distortion of the inlet flow. The screens were designed to provide a total pressure loss,

$$\frac{P_{\max} - P_{\min}}{P_{\max}} = 0.067.$$

This total pressure loss gave the same axial velocity distortion at the rig design inlet Mach number of 0.42 (at the screen location) as that calculated for a total pressure loss of .0.15 at a Mach number of 0.6.

The required screen porosity was obtained as a function of

$(P_{\max} - P_{\min})/q_{\text{avg}}$  and  $M_{\text{avg}}$  from Reference 4. The terms  $q_{\text{avg}}$  and  $M_{\text{avg}}$  refer to the average velocity equivalent pressure and Mach number immediately downstream of the screen. Both screens had a 0.028-inch diameter wire on a 4 mesh.

The screen was located 9.7 inches upstream of the inlet guide vane leading edge, as shown in figure 2. Photographs showing the radial and circumferential distortion screens are presented in figures 4 and 5, respectively.

### Instrumentation

Overall performance with distorted inlet flow was based on measurements obtained at Instrumentation Stations 0 and 2A, shown in figures 1 and 2. Four radial rakes spaced approximately 90 degrees apart and having Kiel type total pressure sensors at the 10, 30, 50, 70, and 90% span positions (from the outer wall) were located at Station 0. Four approximately equally spaced wall pressure taps were provided on both the inner and outer wall at Station 0 for static pressure measurement. The circumferential locations of these instruments relative to the 90-degree distortion screen are shown in figure 6. Weight flow was measured using an orifice in the inlet duct, and inlet temperature was measured in the inlet plenum chamber. Rotor speed was measured by means of an electromagnetic sensor.

The circumferential locations of instruments at Station 2A are shown in figure 7. Stage exit total pressure was measured by means of circumferential rake probes. For the radial distortion, two probes were used; one probe had three 14-tube rakes at 10, 50, and 90% span and the other probe had two 14-tube rakes at 30 and 70% span. These probes were positioned 18 degrees apart. A third probe having two 14-tube rakes at 30 and 70% span was installed for the circumferential distortion test. This probe was located in the expected region of distorted flow at Station 2A as shown in figure 7. The probe was repositioned radially for each test point to cover the 10, 30, 50, 70, and 90% span locations. The three rake probes could also be repositioned in circumferential slots to keep the stator wakes approximately centered on the rakes when the stator geometry was changed from the SLT0 to the cruise configuration. Two Kiel head radial rakes were also used at Station 2A for total pressure measurement. One rake was connected to manometers for the purpose of setting pressure ratio conditions and the other rake was close-coupled to fast response pressure transducers for stall transient total pressure measurements. For the circumferential distortion tests an additional radial rake was installed to provide stall transient measurements in the distorted as well as in the undistorted flow region. Static pressure at Station 2A was measured by means of four static pressure taps on the inner and outer wall, located as shown in figure 7.

Stage exit temperature was measured by means of four radial total temperature rakes spaced approximately 90 degrees apart. The data recording system is described in Reference 3.

## PROCEDURES

### Test Procedure

Overall performance data were obtained for the SLTO and cruise geometry configurations of the variable-geometry stage at rotor speeds of 70, 80, and 100% of the design equivalent rotor speed. Four data points were recorded at each rotor speed to define the stage characteristic from choke to stall. The approximate steady-state stall point was determined from rotor blade strain gage output monitored on oscilloscopes and stage exit total pressure indicated on manometers. The near stall point was set as close to the stall flow as practical.

Transient measurements of orifice pressures, stage inlet and exit total pressures, and rotor speed were obtained at the rate of 600 samples per minute as the stage was operated into and out of stall at each rotor speed to precisely define the stall point. This procedure is described in more detail in Reference 3.

### Data Reduction Procedure

Two different methods of data reduction were utilized to calculate overall performance for the radial and the circumferential distortion configurations. For the radial distortion, the method described in Reference 2 was used with the exception that stage inlet total pressure was the mass flow average value calculated from the Station 0 radial rake total pressure data rather than the plenum pressure. Linear interpolation between the Station 0 inner and outer wall static pressures was used to define local Mach number and weight flow. Stage exit pressure was obtained by mass-flow averaging the wake probe data first circumferentially at each span location (to define the radial profile) and then mass-flow averaging radially. Linear interpolation between inner and outer wall static pressure data was used to define local Mach number and weight flow at Station 2A.

The stage exit average temperature was obtained by arithmetically averaging the four radial rake temperature measurements at each of five span locations to obtain a radial profile, and subsequently calculating the mass-flow average of the radial profile.

All of the pressure and temperature data were corrected to NASA standard conditions.

Because the existing data reduction computer programs were not designed to handle an asymmetric flow distribution, a separate computer program was prepared for calculation of overall performance for the circumferential (90-degree sector screen) distortion configuration. Two sets of radial profiles of total pressure and total temperature were generated by means of the instrumentation located in and out of the distorted flow regions at Stations 0 and 2A. The radial static pressure distributions at Station 0 and 2A were based on linear interpolation of the appropriate inner and outer wall static pressures. Mass-flow average values of total pressure and total temperature were thus obtained for the distorted and undistorted flow. Assuming that the circumferential distribution of distorted and undistorted flow maintained approximately the same proportion between Station 0 and Station 2A, the overall average pressures and temperatures were obtained on an area-weighted basis as follows:

$$\bar{P}_0 = \frac{(3) \bar{P}_0 \text{ undistorted} + (1) \bar{P}_0 \text{ distorted}}{4}$$

$$\bar{P}_{2A} = \frac{(3) \bar{P}_{2A} \text{ undistorted} + (1) \bar{P}_{2A} \text{ distorted}}{4}$$

and

$$\bar{T}_{2A} = \frac{(3) \bar{T}_{2A} \text{ undistorted} + (1) \bar{T}_{2A} \text{ distorted}}{4}$$

#### PRESENTATION OF DATA

##### Distortion Screen Total Pressure Loss

The total pressure loss achieved with the radial and circumferential distortion screens is presented in figure 8. The design values of total pressure loss for inlet Mach numbers of 0.6 and 0.42 are shown for comparison with the data. The measured total pressure loss for both screen configurations is in good agreement with the design pressure loss of 0.067 for a Mach number of 0.42. A reasonable extrapolation of the data includes the design pressure loss of 0.15 for an inlet Mach number of 0.6. The data curves approximate lines of constant axial velocity

ratio across the screens. Typical radial and circumferential distributions of total and static pressure at Station 0 obtained with the two distortion screens are shown in figures 9 and 10, respectively. Static pressure distributions for undistorted flow are included for comparison. The Mach numbers in figures 8 through 10 refer to the high pressure flow region.

#### Overall Performance

Stage pressure ratio and adiabatic efficiencies obtained with the radially distorted inlet flow are presented in figure 11 for the SLT0 configuration and figure 12 for the cruise configuration. Overall performance results for the circumferentially distorted inlet flow are presented in figures 13 and 14 for the SLT0 and cruise configurations, respectively. In each figure the stall line and the data points on the stall line were obtained from stall transient data. Pressure ratio and efficiency obtained with undistorted inlet flow (Reference 3) are included in the figures for comparative purposes. In general, the pressure rise characteristics in figures 11 through 14 indicate a significant change in the stall line at high rotor speeds and very little change at the low rotor speed. The stall lines for the SLT0 and cruise configurations with undistorted and distorted inlet flow are compared in figure 15. The SLT0 configuration stage peak efficiency in figure 11 does not appear to be affected by the radial distortion. The cruise configuration peak efficiency shown in figure 12 is down approximately 2 points. The circumferential distortion affected the peak efficiencies of both the SLT0 and cruise configurations, with the largest reduction in efficiency, about 5 points, occurring with the cruise configuration. No firm conclusions can be drawn with respect to efficiency because of the simplified techniques used in averaging for circumferential distortion.

The influence of the two distortion conditions on the stall margins was evaluated on the basis of a pseudo operating line connecting the SLT0 and cruise design points as shown in figure 16. Referring to the points

labeled A and B on the typical constant rotor speed line in the figure, the stall margin is defined as

$$\frac{\left(\frac{P_R}{W\sqrt{\theta/\delta}}\right)_B - \left(\frac{P_R}{W\sqrt{\theta/\delta}}\right)_A}{\left(\frac{P_R}{W\sqrt{\theta/\delta}}\right)_A} \times 100$$

where  $P_R$  is the stage pressure ratio and subscripts A and B refer to the intersection of the speed line with the operating line and stall line, respectively. Discussion of the significance of this stall margin definition is presented in Appendix C.

The 100 and 70% rotor speed lines of the SLTO and cruise configurations operating with radial and circumferential distortion were evaluated in this manner. The results are presented in table 2. In general, for undistorted flow, the SLTO configuration had slightly greater stall margin than the cruise configuration at 100% of design equivalent rotor speed (SLTO conditions); and the cruise configuration had slightly greater stall margin than the SLTO configuration at 70% of design rotor speed (cruise) conditions. At cruise conditions (70% speed) the cruise configuration stall margin with radial distortion was 16.5% greater than that of the SLTO configuration. With circumferential distortion the stall margin of the cruise configuration at cruise operating conditions was approximately 19% greater than that of the SLTO configuration. These comparisons reflect the apparent compensation of the cruise configuration rotor prewhirl for the reduced axial velocities (in the distorted flow region) which tend to maintain tolerable rotor incidence conditions. A tabulation of basic data obtained from the distortion tests is presented in tables B-1 and B-2 of Appendix B. The undistorted results are given in reference 3.



Table 2. Evaluation of Stall Margin

Configuration	SLT0		Cruise	
Percent Design Equivalent Rotor Speed	100	70	100	70
Stall Margin: Undistorted,%	48	37	40	39
Stall Margin: Radial Distortion,%	34	24	31	28
Stall Margin: Circumferential Distortion,%	29	32	29	38

#### References

1. "Single Stage Experimental Evaluation of Variable Geometry Guide Vanes and Stators, Part I - Analysis and Design," NASA CR-54554, PWA FR-2112.
2. "Single Stage Experimental Evaluation of Variable Geometry Guide Vanes and Stator Blading, Part III - Data and Performance for Variable Camber Guide Vanes and Stator A," NASA CR-54556, PWA FR-2638.
3. "Single Stage Experimental Evaluation of Variable Geometry Guide Vanes and Stators, Part IV - Data and Performance for Variable Camber Guide Vanes and Stator B," NASA CR-54557, PWA FR-2639.
4. "Variation with Mach number of Static and Total Pressure through Various Screens," NACA CB No. L5F28.

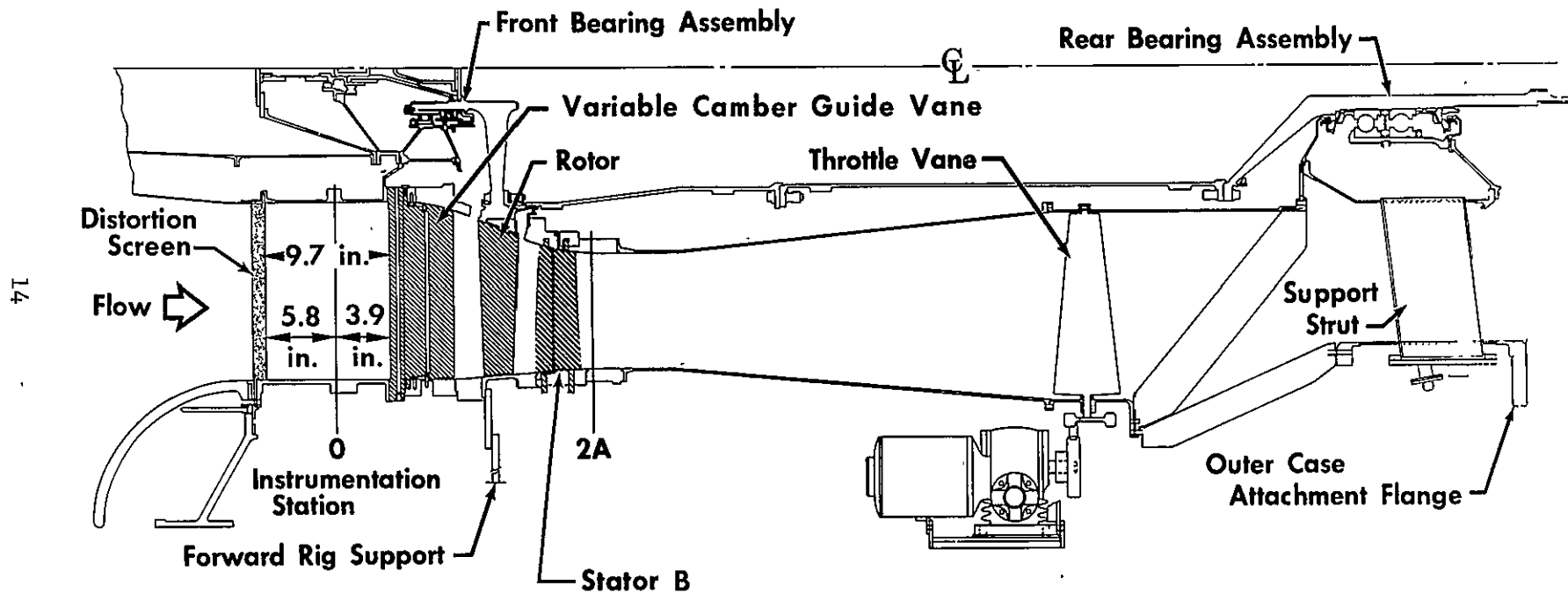


Figure 1. Compressor Rig Showing Axial Location of Distortion Screen and Instrumentation Stations GS 2120G

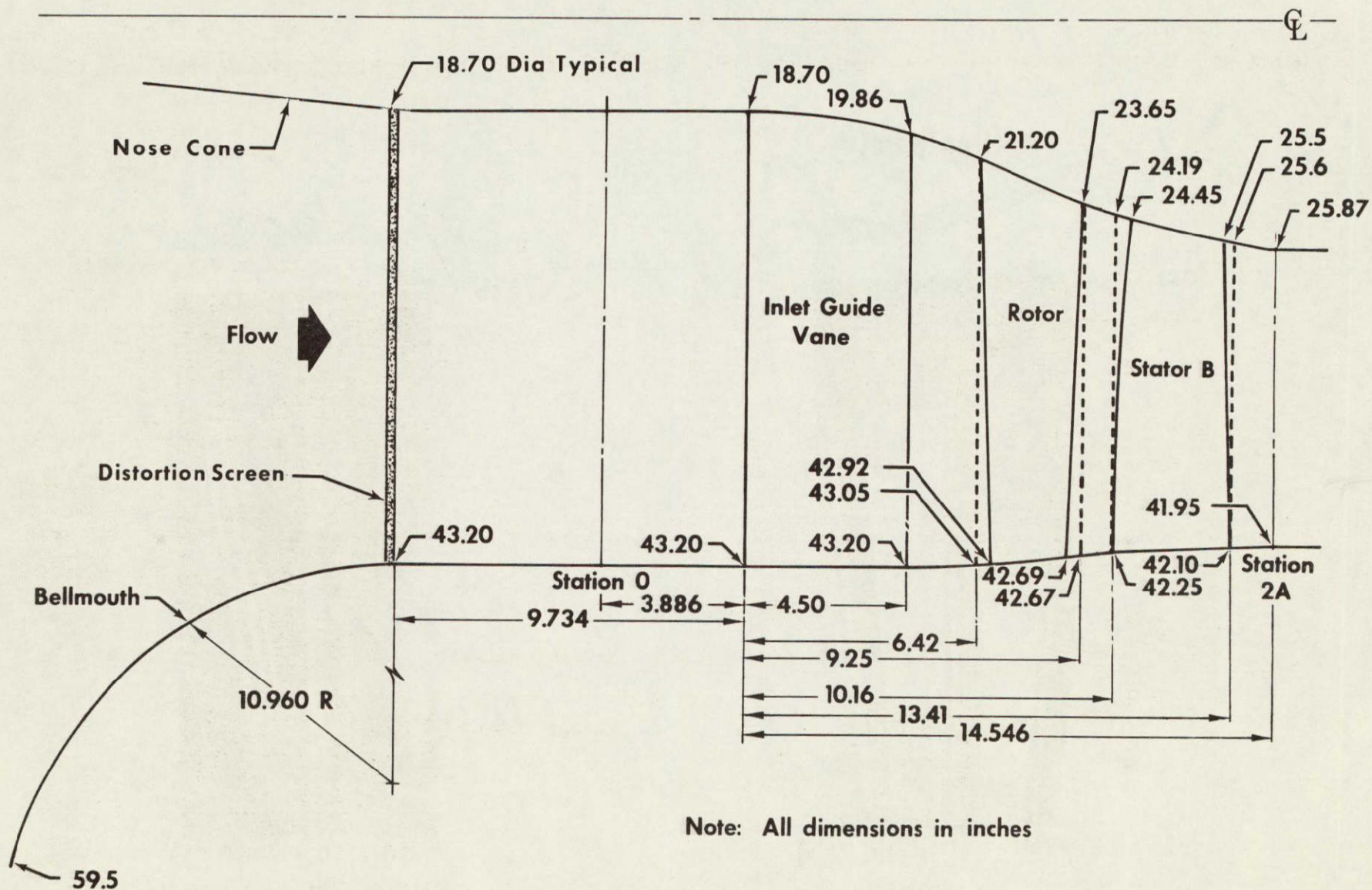
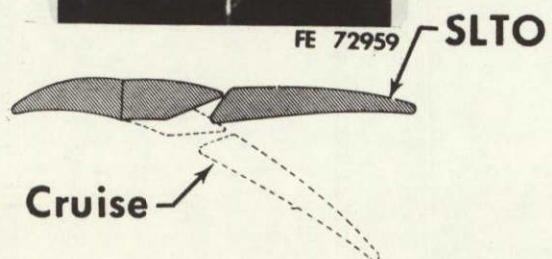


Figure 2. Section View of Flowpath

GS 6614C

**Variable-Camber  
Inlet Guide Vane  
(Cruise Position)**



**Stator B  
(Cruise Position)**

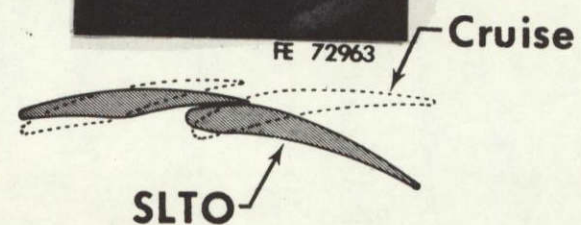
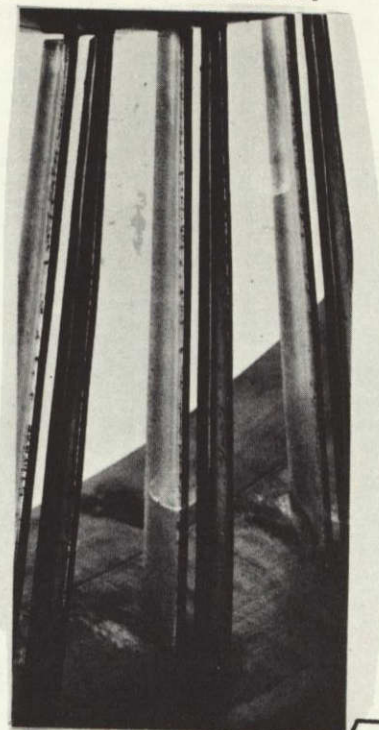


Figure 3. Variable-Geometry Inlet Guide Vane and Stator B

GS 6613C



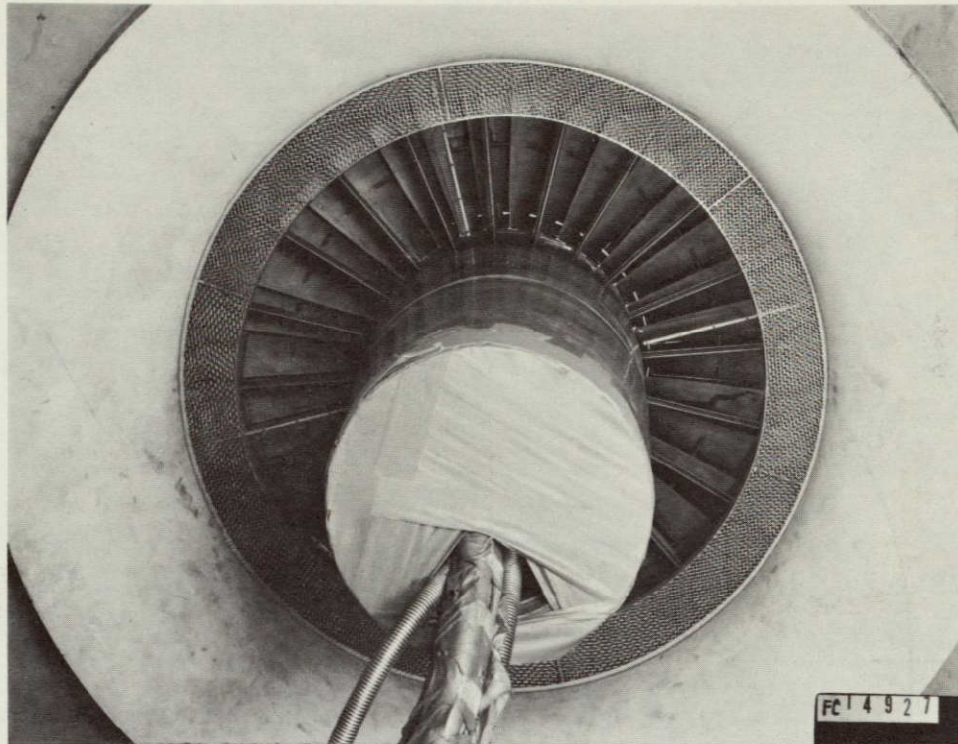


Figure 4. 360-Deg Radial Distortion Screen

FC 14927

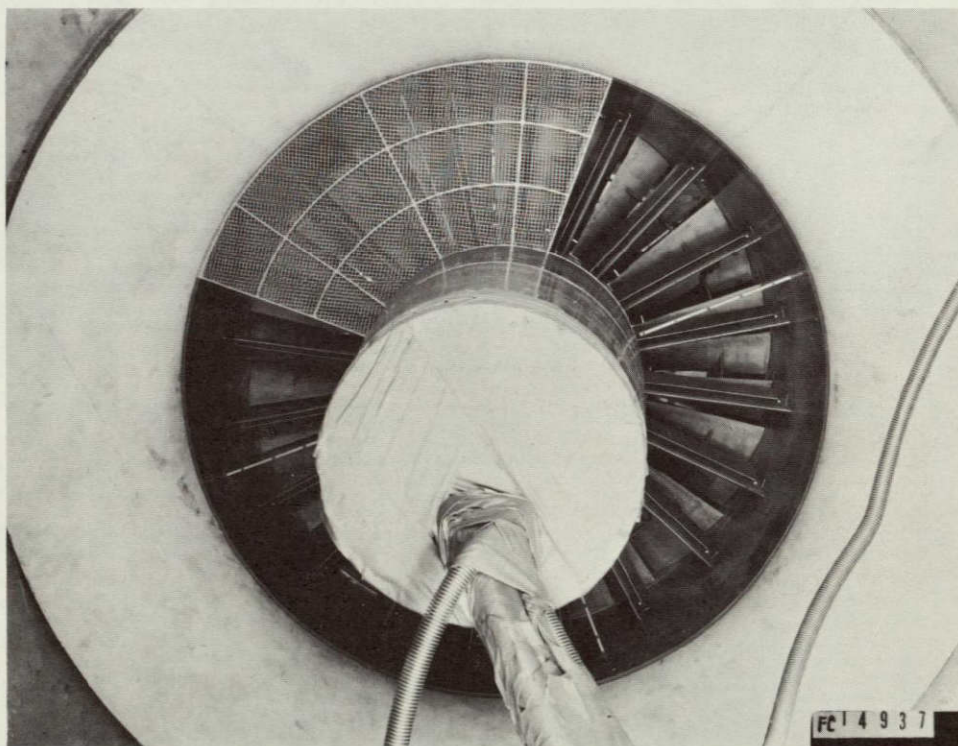


Figure 5. 90-Deg Circumferential Distortion Screen

FC 14937



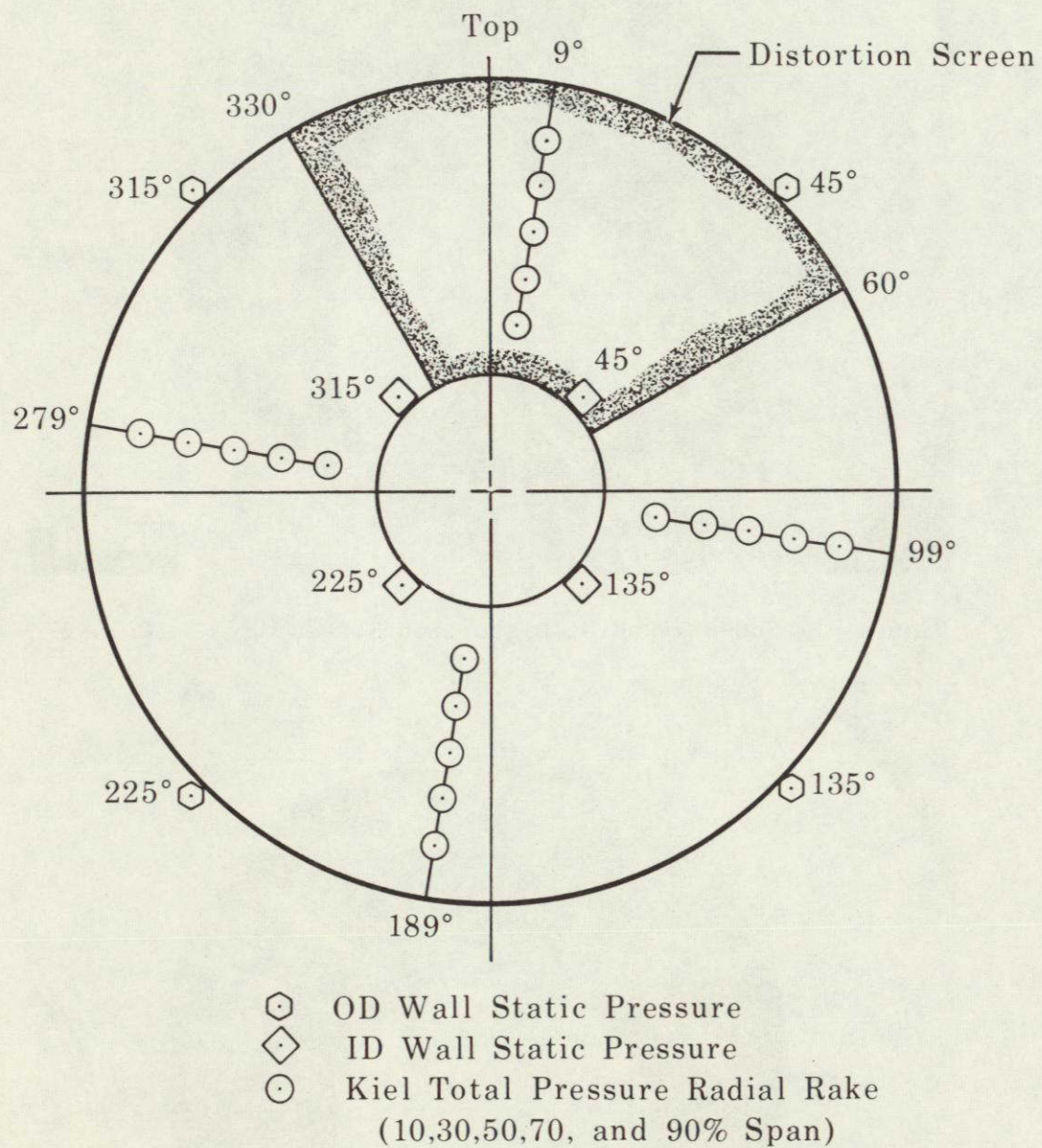


Figure 6. Instrumentation Station 0, View Looking Upstream

FD 27412

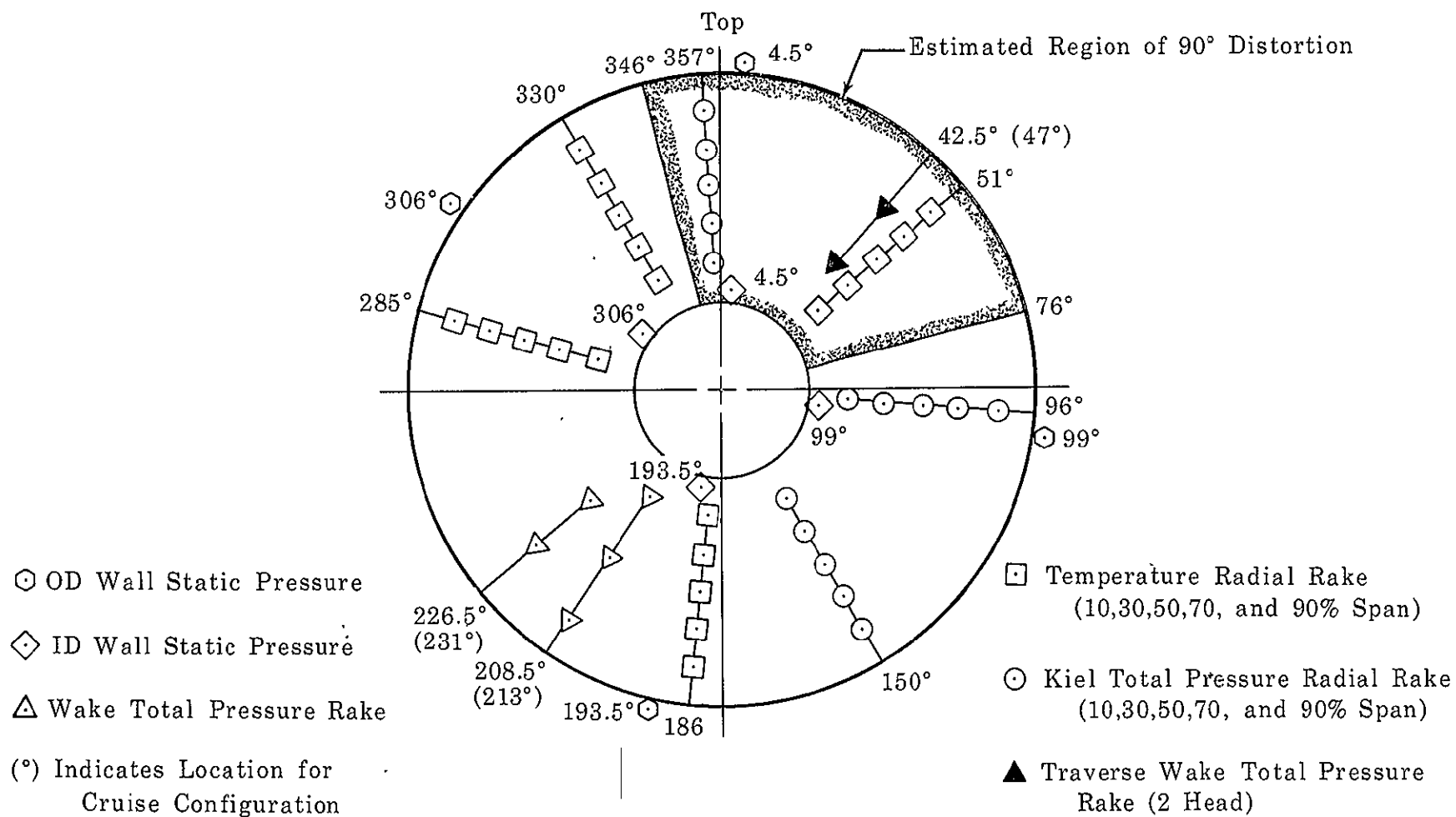


Figure 7. Instrumentation Station 2A, View Looking Upstream

FD 27413

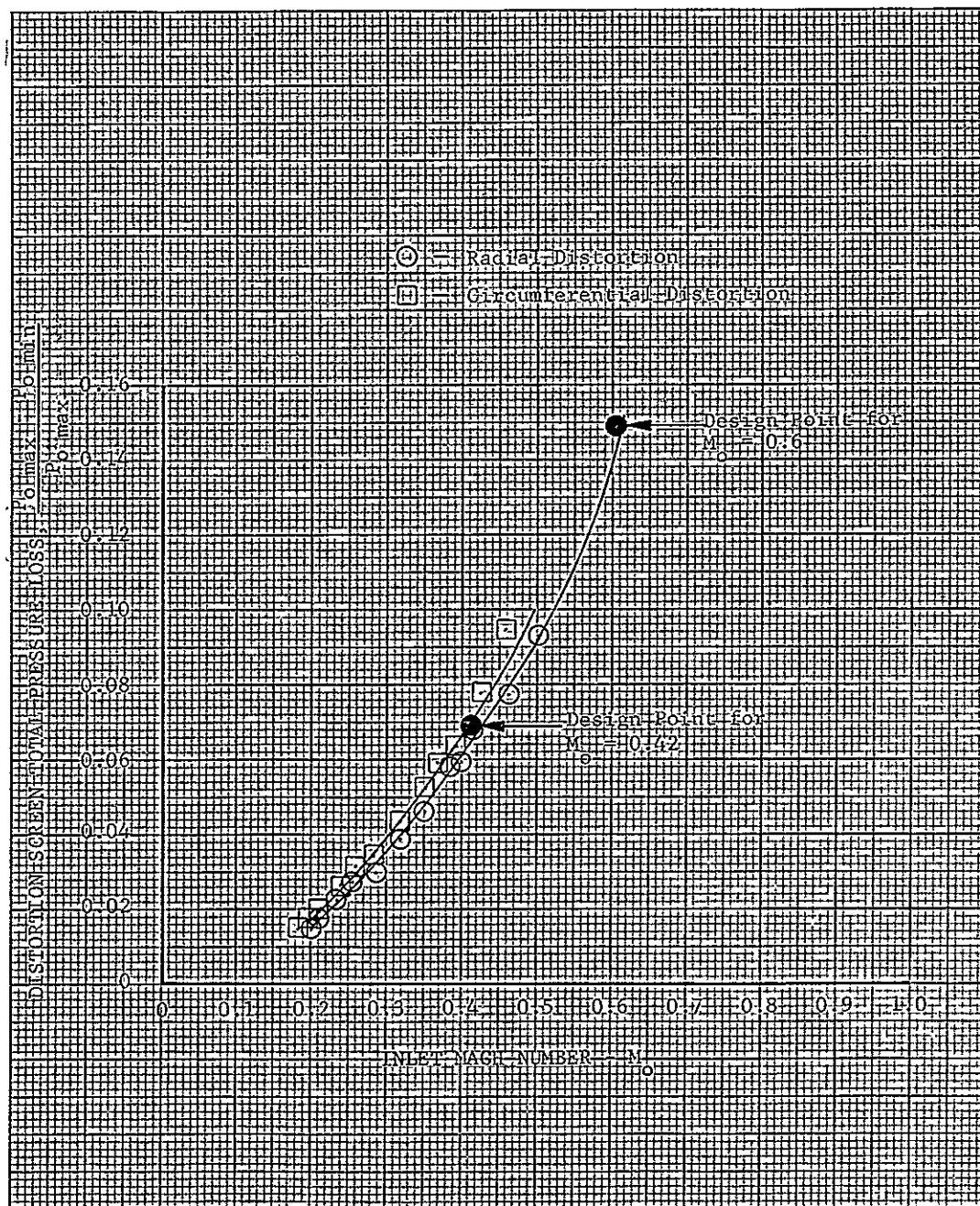


Figure 8. Distortion Screen - Total Pressure Loss



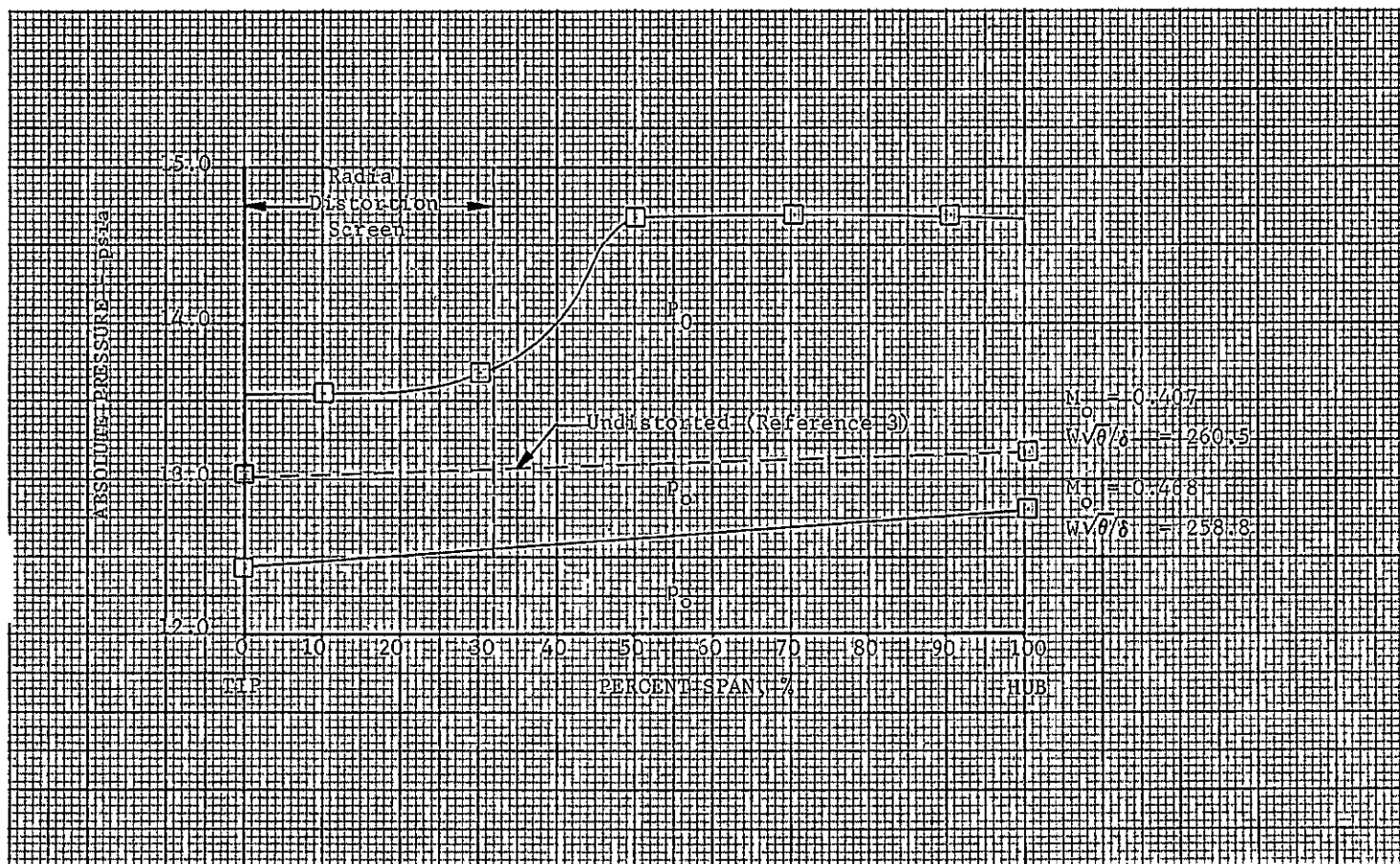


Figure 9. Radial Distribution of Total and Static Pressure at Station 0, Sea Level Takeoff Configuration, 100% Equivalent Rotor Speed, Near Design Flow

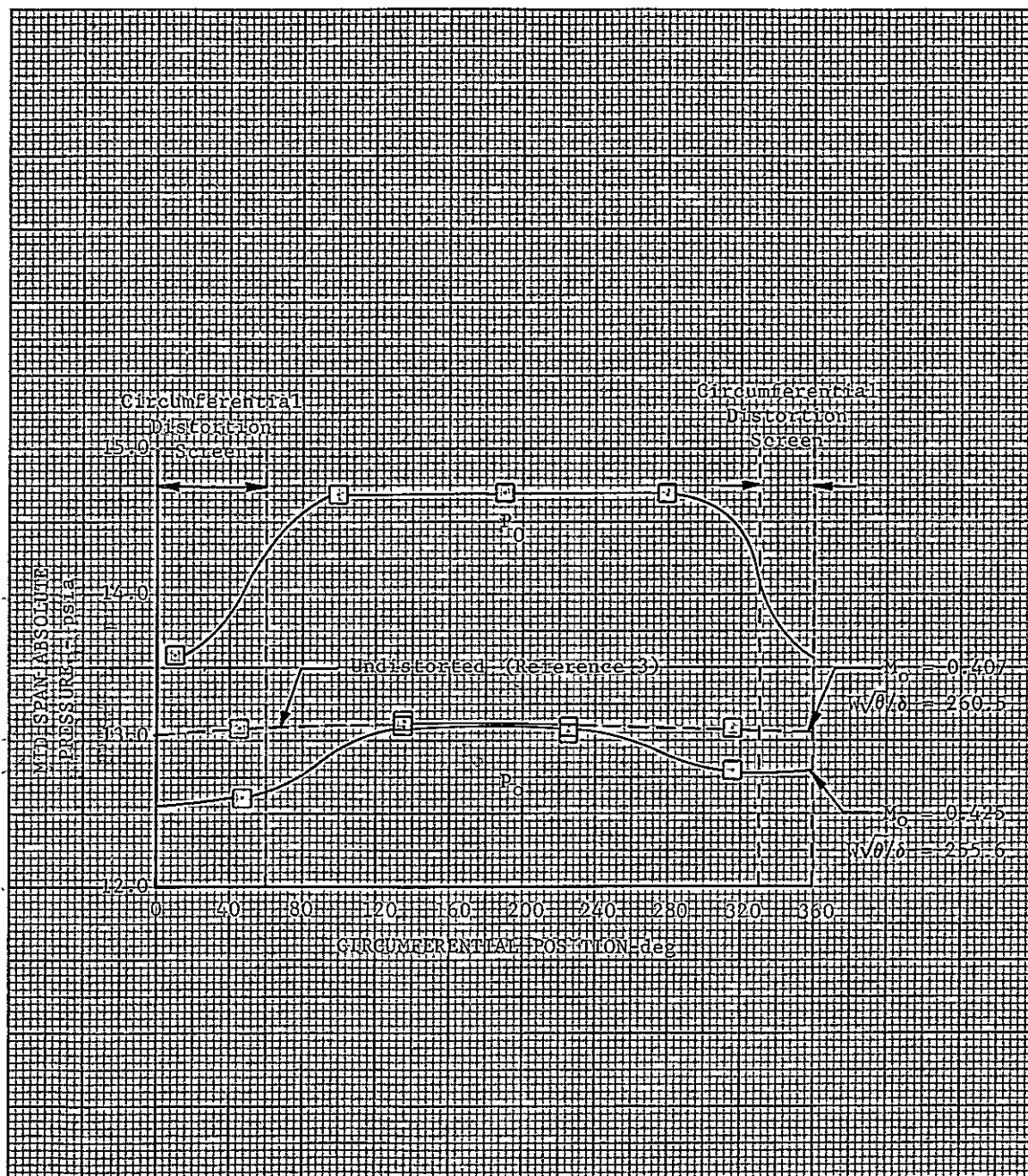
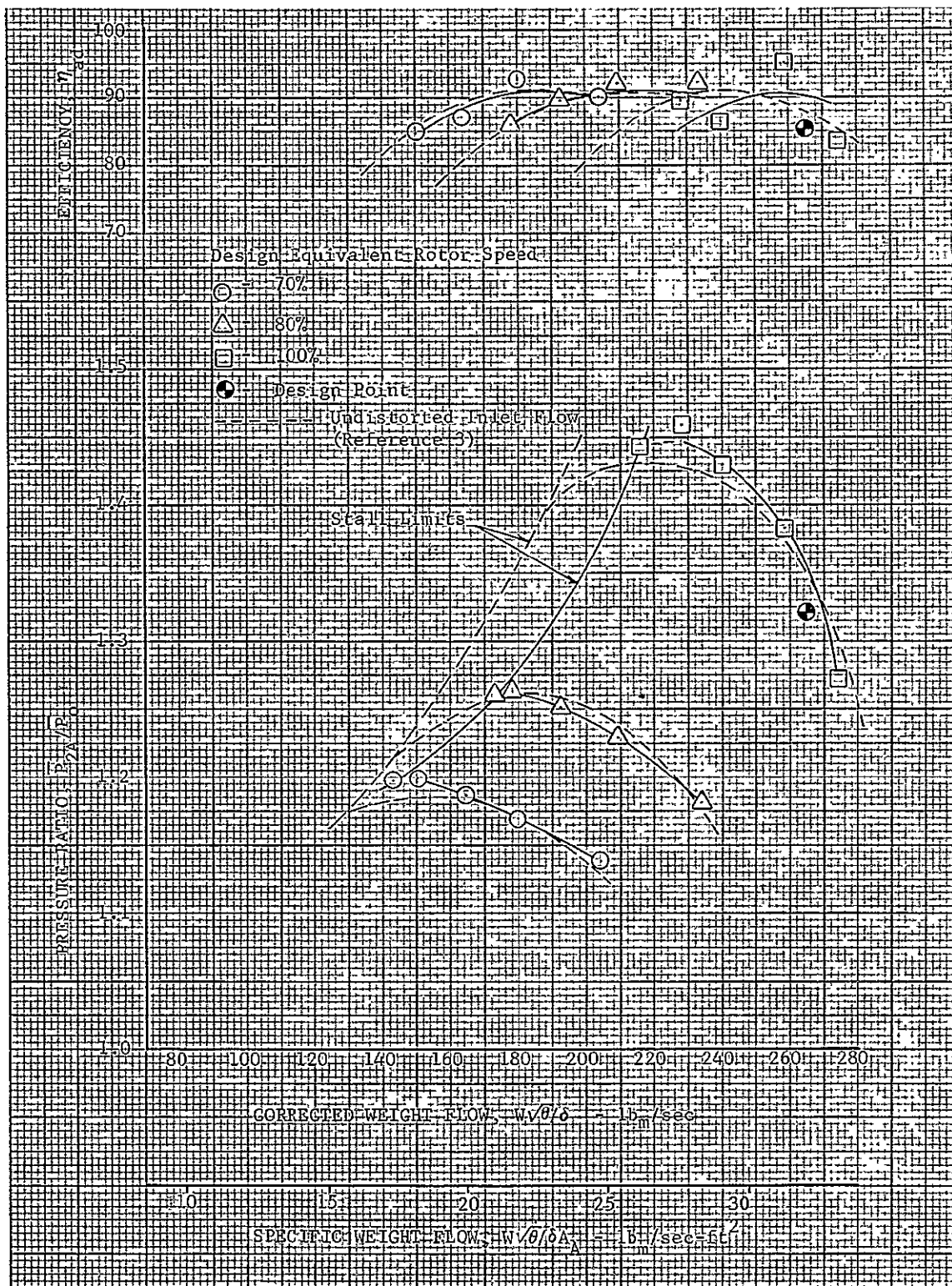
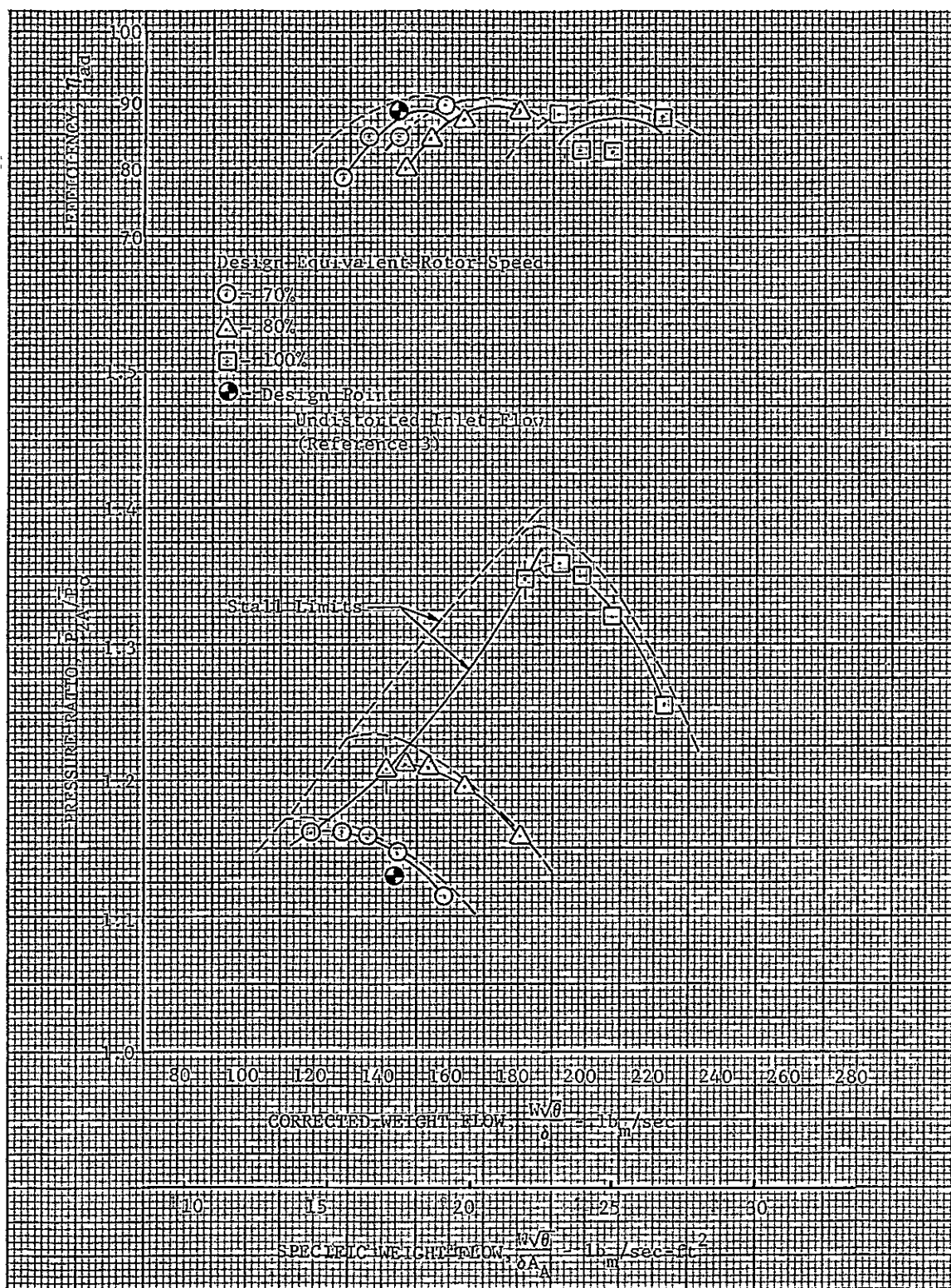


Figure 10. Circumferential Distribution of Total and Static Pressure at Station 0, Sea Level Takeoff Configuration, 100% Equivalent Rotor Speed, Near Design Flow



DF 69710

Figure 11. Overall Performance With 360-Deg Radial Distortion - SLTO Configuration



DF 69711

Figure 12. Overall Performance With 360-Deg Radial Distortion - Cruise Configuration

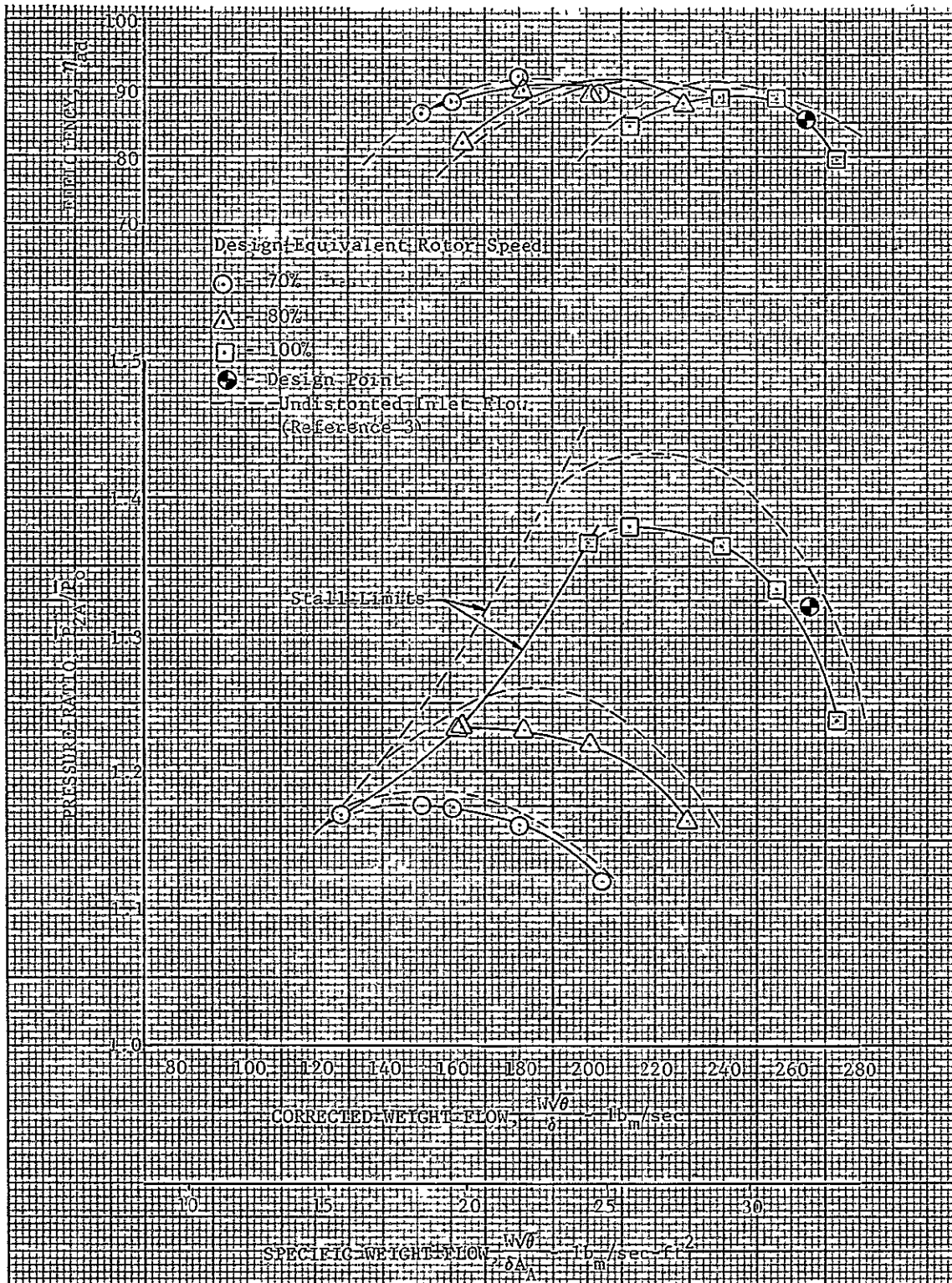
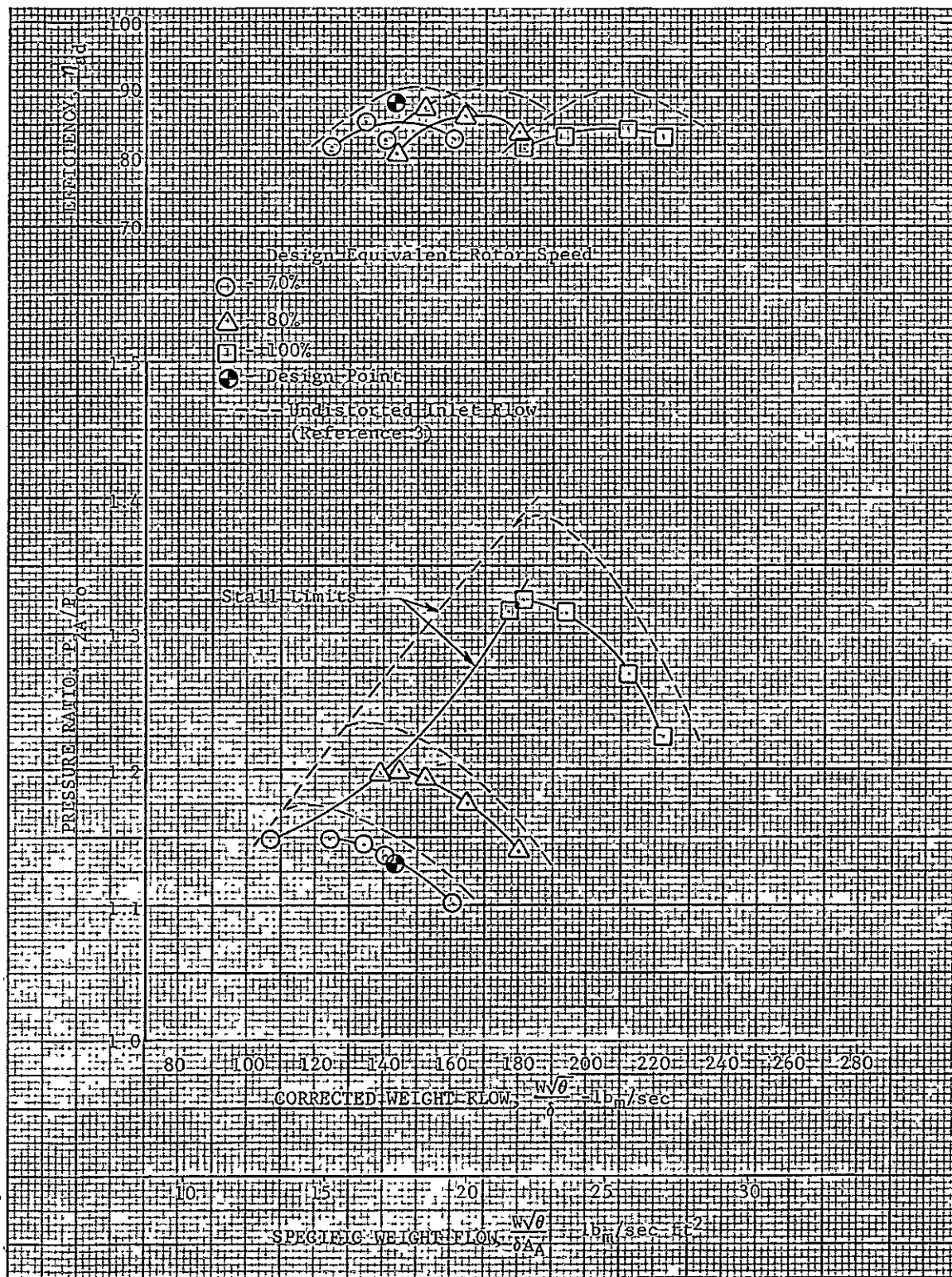


Figure 13. Overall Performance With 90-Deg Circumferential Distortion - SLTO Configuration

DF 69712





DF 69713

Figure 14. Overall Performance With 90-Deg Circumferential Distortion - Cruise Configuration

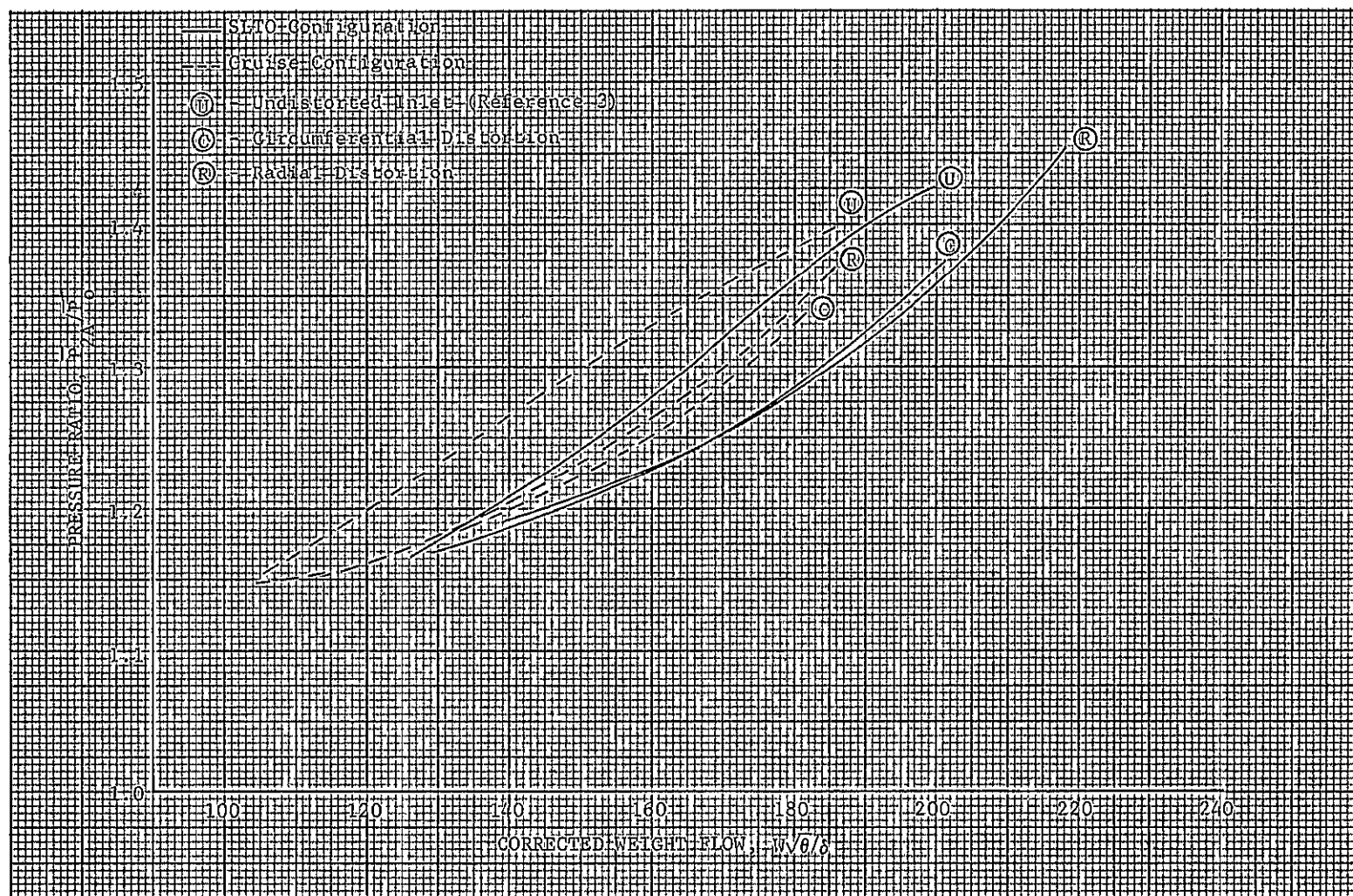
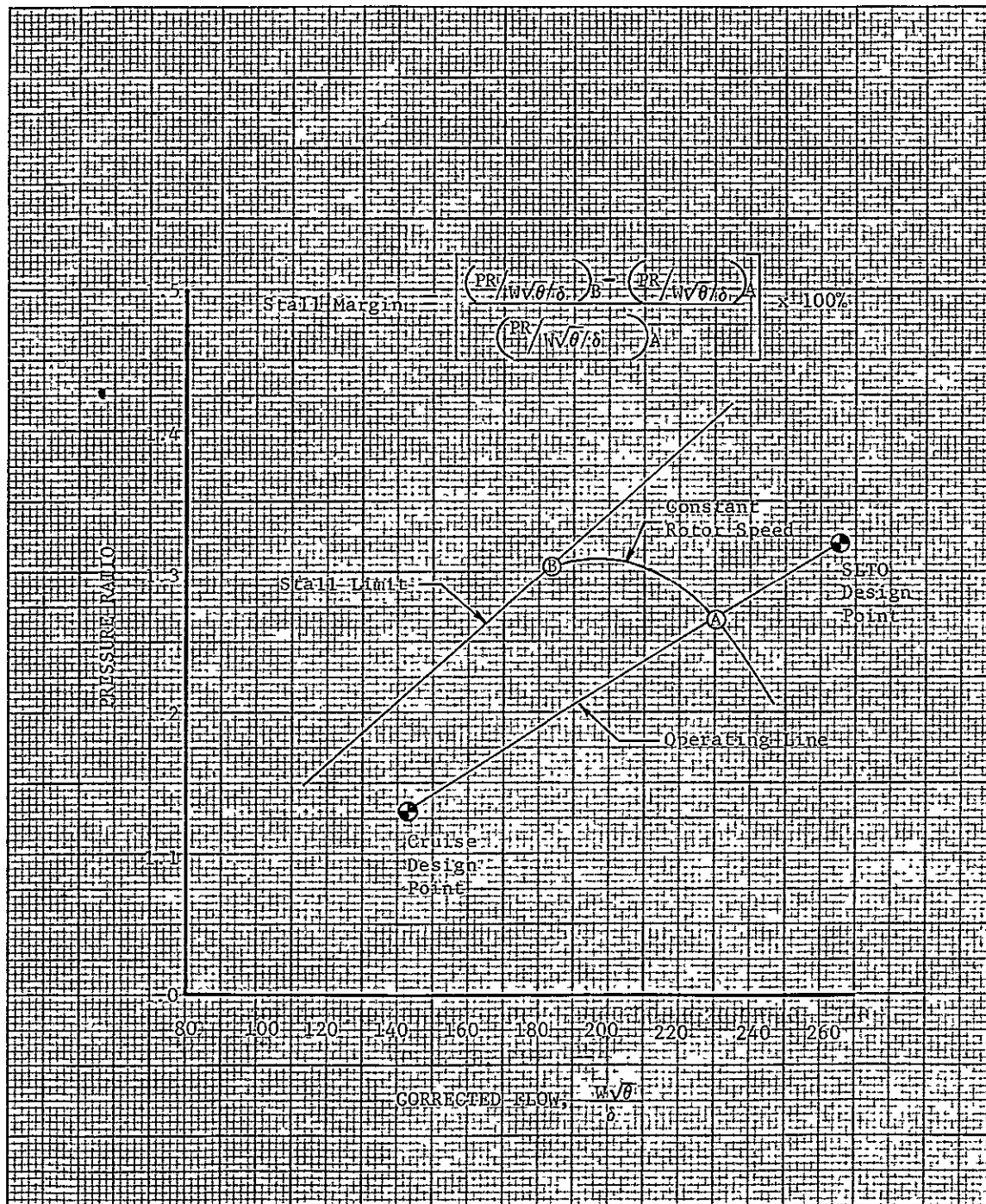


Figure 15. Stall Limit Comparisons



DF 69715

Figure 16. Operating Line For Evaluation of Stall Margin



APPENDIX A  
DEFINITION OF SYMBOLS AND PERFORMANCE VARIABLES

Definition of Symbols

$A_A$	Flow path annular area, ft <sup>2</sup>
$c$	Chord length, in.
$i_m$	Incidence Angle, deg (based on equivalent circular arc meanline for stators)
$M$	Mach number
$P$	Total pressure, psia
$P_R$	Stage total pressure ratio
$p$	Static pressure, psia
$S$	Blade spacing, in.
SLTO	Sea level takeoff
$T$	Total temperature, °R
$t$	Blade maximum thickness, in.
$W$	Actual flow rate, lb <sub>m</sub> /sec
$\gamma^\circ$	Blade chord angle, deg
$\delta$	Ratio of total pressure to NASA standard sea level pressure of 2116 psf
$\delta^\circ$	Deviation angle, deg
$\eta_{ad}$	Adiabatic efficiency
$\theta$	Ratio of total temperature to NASA standard sea level temperature of 518.7°R
$\kappa$	Blade metal angle, deg (based on equivalent circular arc meanline for stator vanes)
$\sigma$	Solidity, $c/S$
$\phi$	Blade camber angle, deg (based on equivalent circular arc meanline for stator vanes).
Subscripts	
$O$	Compressor inlet instrumentation station
$2A$	Stator exit instrumentation station
$A$	Point on operating line
$B$	Point on stall line
Superscripts	
$-$	Mass average value

# DEFINITION OF PERFORMANCE VARIABLES

Stage Pressure Ratio:

$$\frac{\bar{P}_{2A}}{\bar{P}_o}$$

---

Corrected Flow:

$$W \sqrt{\theta} / \delta$$

Corrected Specific Flow:

$$\frac{W \sqrt{\theta}}{\delta A_A}$$

Corrected Rotor Speed:

$$N / \sqrt{\theta}$$

Adiabatic Efficiency:

$$\frac{(\bar{P}_{2A} / \bar{P}_o)^{\frac{\gamma-1}{\gamma}} - 1}{\bar{T}_{2A} / 518.7 - 1}$$

APPENDIX B  
BASIC DISTORTION DATA

This appendix presents basic distortion data in tabular form. The following data are presented:

1. Wall static pressures for Instrumentation Stations 0, 1, 2, and 2A (See figure 1.)
2. Total pressure at 10, 30, 50, 70, and 90% span from tip for Instrumentation Stations 0 and 2A
3. Total temperature at 10, 30, 50, 70, and 90% span from tip for Instrumentation Station 2A.

Data for the test with 360-degree radial distortion are presented in table B-1. Data for the test with 90-degree circumferential distortion are presented in table B-2. Each page of the tables represents one data point and is identified accordingly by  $\frac{W\sqrt{\theta}}{\delta}$ , data point number, and rotor speed. Data omissions in the tables indicate faulty data; these data were not used in the performance calculations.

The circumferential locations (circ. loc. deg.) refer to those shown in the instrumentation diagrams in figures 6 and 7 for Stations 0 and 2A. The circumferential locations for the Station 1 and 2 static pressure data are referenced to the 0-degree location indicated in these figures.

Table B-1. Basic Distortion Data 360-Degree Radial Distortion

$$W\sqrt{\sigma}/s = 149.774$$

$$P_{2R}/P_0 = 1.1985$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 222.

SLTO CONFIGURATION

70 % EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.	STATION 0		WALL STATICS			STATION 2			STATION 2A		
	TIP	HUB	CIRC. LOC. DEG.	STATION 1 TIP HUB		CIRC. LOC. DEG.	TIP	HUB	CIRC. LOC. DEG.	TIP	HUB
45	14.050	14.160	3	13.927		10	*	15.345	45	16.294	16.059
135	14.327	14.157	102	13.914	14.225	94.5	16.414	15.352	99	16.368	16.022
225	14.037	14.167	197.5	13.911		180	16.013	15.348	193.5	16.343	16.098
315	14.021	14.164	283.5	13.935	14.247	270		5.403	306	16.315	16.938

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	533.650	527.110	521.720	520.170	519.010
96	533.650	527.110	522.100	519.390	520.940
225	532.880	526.340	520.940	520.940	518.620
330			520.170		

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.388	14.423	14.697	14.696	14.699
99	14.391	14.422	14.710	14.705	14.704
189	14.378	14.373	14.714	14.699	14.702
279	14.382	14.413	14.692	14.693	14.700

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
203.3	17.694		17.161		16.867
226.5		17.396		16.959	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	16.051	16.306	16.281	16.353	16.021	16.187	16.413	16.362	16.064

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{G}/S = 163.707$$

$$P_{2A}/P_0 = 1.1862$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 223.

SLTO CONFIGURATION

70 % EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.			CIRC. LOC. DEG.			CIRC. LOC. DEG.			CIRC. LOC. DEG.		
STATION 0			STATION 1			STATION 2			STATION 2A		
TIP HUB			TIP HUB			TIP HUB			TIP HUB		
45	13.918	14.057	3	13.767		10	*	15.132	45	16.026	15.795
135	13.904	14.060	102	13.782	14.133	94.5	15.194	15.132	99	16.103	15.776
225	13.910	14.075	137.5	13.760		190	15.850	15.155	193.5	16.090	15.849
315	13.902	14.054	230.5	13.774	14.142	270		15.212	306	16.032	

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	552.130	547.900	543.060	541.840	541.840
186	554.740	543.300	543.460	541.440	542.250
283	552.330	547.100	543.870	541.030	542.250
330			541.030		

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.295	14.353	14.670	14.686	14.694
99	14.302	14.347	14.692	14.689	14.704
195	14.304	14.320	14.702	14.699	14.693
270	14.312	14.364	14.688	14.691	14.693

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
208.5	17.430		17.079		16.705
226.5		17.268		16.990	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.044	16.067	16.198	16.121	15.894	15.006	16.210	16.092	15.858

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{E}/S = 180.080$$

$$P_{2A}/P_0 = 1.1683$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 224.

SLTO CONFIGURATION

70% EQUIVALENT RADIAL SPEED

HALL STATICS

CIRC. LOC. DEG.	STATION 0			CIRC. LOC. DEG.	STATION 1			CIRC. LOC. DEG.	STATION 2			CIRC. LOC. DEG.	STATION 2A		
	TIP	HUB			TIP	HUB			TIP	HUB			TIP	HUB	
45	13.719	13.876		3	13.554			10	*	14.806		45	15.596	15.314	
135	13.698	13.822		102	13.535	14.003		94.5	15.846	14.791		99	15.642	15.366	
225	13.711	13.893		187.5	13.529			180	15.573	14.856		193.5	15.698	15.385	
315	13.709	13.876		226.5	13.529	14.015		270		14.932		306	15.529		

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	548.930	548.280	540.030	539.210	539.000
186	550.130	545.300	541.200	539.210	539.210
285	546.510	544.090	540.440	539.620	539.210
320			539.020		

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.241	14.257	14.690	14.691	14.685
99	14.260	14.314	14.702	14.697	14.704
199	14.238	14.243	14.719	14.706	14.704
279	14.207	14.273	14.698	14.700	14.705

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
208.5	17.098		16.867		16.724
226.5		15.977		16.786	

* (DEGREES)	351	334	355.5	357	359	1.5	4	6	9
	15.521	15.685	16.066	15.762	15.562	15.671	15.800	15.770	15.549

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

 $W/S = 203.910$  $P_{2A}/P_0 = 1.1383$ 

360 DEGREE RADIAL DISTORTION

POINT NUMBER 220.

SLTO CONFIGURATION

70% EQUIVALENT FLOW SPEED

HALL STATICS

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	12.452	13.638	3	13.261		10	*	14.179	45	14.635	14.222
135	13.480	13.633	102	13.277	13.701	94.5	15.038	14.097	99	14.620	14.388
225	13.437	13.635	187.5	13.244		180	14.876	14.205	193.5	14.551	14.270
315	13.443	13.630	286.5	13.251	13.712	270		14.335	306	14.473	

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	525.530	522.430	519.880	518.890	519.280
183	525.750	523.610	520.460	519.280	519.280
285	525.970	523.220	520.460	519.670	520.070
330	520.850	520.850	519.670		

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.001	14.103	14.660	14.686	14.701
99	14.067	14.116	14.695	14.697	14.702
189	14.036	14.051	14.703	14.704	14.683
279	14.063	14.145	14.679	14.681	14.687

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
208.5	16.396		16.395		16.423
226.5		16.337		16.394	

* (DEGREES)	331	354	355.5	357	359	1.5	4	6	9
	14.014	14.839	15.346	14.993	14.874	14.980	14.959	14.957	14.785

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$Wt/G = 177.930$$

$$P_{2A}/P_0 = 1.2649$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 227.

SLTO CONFIGURATION

80 % EQUIVALENT ROTOR SPEED

CIRC. LOC. STATION 0			WALL STATICS			CIRC. LOC. STATION 2			CIRC. LOC. STATION 2A		
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	13.718	13.945	3	13.582		10	*	15.529	45	17.563	16.455
135	13.723	13.935	102	13.206	14.019	94.5	16.933	15.535	99	16.897	16.407
225	13.728	13.939	187.5	13.556		180	16.444	15.526	193.5	16.853	16.512
315	13.710	13.918	286.5	13.593	14.042	270		15.599	306	16.835	

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	569.960	560.330	552.270	550.650	548.240
135	569.160	560.730	553.080	549.850	551.470
285	560.730	558.720	551.470	551.870	548.640
330			549.850		

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.253	14.271	14.662	14.680	14.692
99	14.245	14.272	14.634	14.686	14.692
189	14.236	14.228	14.696	14.688	14.684
279	14.210	14.265	14.676	14.672	14.682

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
208.5	18.589		17.965		17.656
226.5		18.299		17.811	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	16.449	16.797	17.006	16.915	16.441	16.712	17.001	16.934	16.473



Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W_{16}/S = 172.410$$

$$P_{2A}/P_0 = 1.2504$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 228.

SLTD CONFIGURATION

80 % EQUIVALENT ROTOR SPEED

CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	13.351	13.771	3	13.320		10	*	15.214	45	16.402	16.075
135	13.324	13.754	102	13.324	13.912	94.5	16.586	15.239	99	16.507	16.056
225	12.568	13.757	187.5	13.302		180	16.253	15.281	193.5	16.479	16.138
315	13.526	13.761	296.5	13.318	13.922	270		15.336	306	16.388	

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
51	564.040	556.410	549.960	547.950	548.350
126	564.040	556.000	549.960	547.140	549.150
285	562.830	555.200	550.360	546.730	547.950
330		549.560	547.950		

INLET TOTAL PRESSURE  
STATION 0

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
9	14.138	14.211	14.677	14.684	14.691
99	14.152	14.236	14.685	14.691	14.694
189	14.137	14.142	14.690	14.677	14.681
279	14.116	14.156	14.654	14.662	14.677

DISCHARGE TOTAL PRESSURE  
STATION 2A

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
208.5	19.411		17.764		17.327
226.5		18.098		17.618	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	16.164	16.455	16.763	16.548	16.230	16.323	16.620	16.614	16.245

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{S} = 209.240$$

$$P_{2A}/P_0 = 1.2295$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 229.

SLTO CONFIGURATION

80 % EQUIVALENT ROTOR SPEED

CIRC.			CIRC.			CIRC.			CIRC.		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	13.327	13.553	3	13.086		10	*	14.804	45	15.858	15.432
135	13.313	13.547	102	13.100	13.719	94.5	16.195	14.795	99	15.929	15.569
225	13.320	13.555	187.5	13.052		180	15.876	14.877	193.5	15.875	15.580
315	13.320	13.548	286.5	13.093	13.742	270		14.987	306	15.799	

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	559.070	552.210	547.360	545.730	545.730
186	560.200	553.420	548.170	545.730	545.730
285	559.470	552.610	547.750	546.550	546.140
330		548.170	546.140		

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.027	14.099	14.695	14.694	14.705
99	14.067	14.115	14.695	14.702	14.702
189	14.051	14.045	14.727	14.721	14.696
279	14.006	14.083	14.679	14.685	14.704

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
208.5	17.954		17.555		17.359
226.5		17.720		17.479	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.832	16.007	16.320	16.113	15.751	15.894	16.082	16.145	15.791

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W/V/S = 232.600$$

$$P_{2A}/P_0 = 1.1822$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 225.

SLT0 CONFIGURATION

80% EQUIVALENT ROTOR SPEED

CIRC.			WALL			STATICS			CIRC.		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	13.016	13.271	3	12.670		10	*	13.987	45	14.565	14.050
135	12.995	13.284	102	12.690	10.352	94.5	15.144	13.949	99	14.534	14.295
225	12.963	13.284	187.5	12.642		180	17.942	14.056	193.5	14.507	14.132
315	12.943	13.262	285.5	12.646	13.384	270		14.230	306	14.393	

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	550.320	544.670	541.020	541.420	542.640
136	552.340	546.700	543.050	541.420	541.420
225	551.930	546.290	542.240	542.240	545.480
330		543.050	541.420		548.310

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	13.817	13.934	14.686	14.697	14.691
99	13.878	14.017	14.702	14.690	14.690
189	13.956	13.868	14.733	14.723	14.694
279	13.816	12.929	14.688	14.639	14.703

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
208.5	16.905		16.943		16.968
226.5		16.837		16.987	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	14.813	14.877	15.039	15.014	14.969	14.950	14.964	15.055	14.849

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{S} = 227.660$$

$$P_{1A}/P_0 = 1.4593$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 232.

SLT0 CONFIGURATION

100% EQUIVALENT K<sub>1</sub>-1 SPEED

CIRC. LOC. DEG. STATION 0 TIP HUB			WALL STATICS CIRC. LOC. DEG. STATION 1 TIP HUB			CIRC. LOC. DEG. STATION 2 TIP HUB			CIRC. LOC. DEG. STATION 2A TIP HUB		
45	13.056	13.270	3	12.699		10	*	16.117	45	18.080	17.544
135	13.046	13.341	102	16.629	13.579	94.5	18.553	16.128	99	18.266	17.475
225	13.091	13.372	197.5	12.575		180	17.654	16.034	193.5	18.280	17.692
315	13.093	13.369	286.5	12.690	13.617	270		16.196	306	18.250	

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	600.790	584.470	569.580	566.760	561.940
186	599.250	582.750	569.580	566.750	566.350
285	600.020	582.750	570.390	569.580	561.940
330			564.350		

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	13.842	13.953	14.604	14.686	14.699
99	13.940	13.965	14.705	14.712	14.717
189	13.893	13.916	14.748	14.731	14.722
279	13.854	13.964	14.690	14.713	14.546

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
209.5	21.517		19.955		19.145
226.5		20.633		19.507	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	17.637	18.255	18.651	18.450	17.640	18.020	18.472	18.448	17.628

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{S} = 239.710$$

$$P_{2A}/P_0 = 1.4291$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 233.

SLTD CONFIGURATION

100 % EQUIVALENT PCT-R SPEED

WALL STATICS

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	12.857	13.161	3	12.324		10	*	15.663	45	17.761	17.140
135	12.815	13.139	102	12.352	13.379	94.5	18.119	15.794	99	17.921	17.124
225	12.844	13.140	197.5	12.289		190	17.420	15.714	193.5	17.884	17.286
315	12.741	13.131	286.5	12.383	13.422	270		15.827	306	17.829	

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	594.220	572.980	567.590	563.970	562.770
195	594.610	579.400	568.790	563.570	566.380
285	595.380	579.400	569.200	565.980	563.570
330			565.530		

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	13.714	13.890	14.662	14.690	14.694
99	13.937	13.832	14.693	14.712	14.704
189	13.763	13.775	14.738	14.714	14.705
279	13.755	13.891	14.686	14.695	14.703

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
208.5	20.948		19.862		18.978
226.5		20.383		19.495	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	17.149	17.717	18.275	17.978	17.136	17.540	18.015	17.992	17.292

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$W/V/S = 258.820$

$P_{2A}/P_0 = 1.3830$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 234.

SLTO CONFIGURATION

100% EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG. STATION 0			CIRC. LOC. DEG. STATION 1			CIRC. LOC. DEG. STATION 2			CIRC. LOC. DEG. STATION 2A		
TIP HUB			TIP HUB			TIP HUB			TIP HUB		
45	12.462	12.816	3	11.954		10	*	14.837	45	16.716	16.032
135	12.453	12.786	102	11.989	12.998	94.5	17.165	14.868	99	16.807	16.156
225	12.413	12.818	187.5	11.893		180	16.517	14.947	193.5	16.797	16.224
315	12.403	12.790	286.5	11.998	13.046	270		15.061	306	16.670	

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
51	587.410	574.590	564.500	561.290	559.670
186	561.290	588.570	576.630	566.510	560.880
285	574.590	587.800	574.590	565.710	562.490
330		564.910	564.910	560.880	

INLET TOTAL PRESSURE  
STATION 0

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
9	13.562	13.683	14.634	14.696	14.679
99	13.597	13.713	14.706	14.714	14.720
189	13.549	13.553	14.748	14.727	14.700
279	13.537	13.678	14.676	14.701	14.711

DISCHARGE TOTAL PRESSURE  
STATION 2A

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
208.5	20.017		19.434		18.881
226.5		19.521		19.103	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	16.328	16.804	17.194	16.925	16.517	16.573	16.996	16.980	16.479

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{S} = 273.620$$

$$P_{2A}/P_0 = 1.2729$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 230.

SLTO CONFIGURATION

100 % EQUIVALENT ROTOR SPEED

CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	12.081	12.553	3	11.611		10	*	13.610	45	14.466	13.613
135	12.073	12.527	102	11.708	12.628	94.5	15.186	13.584	99	14.478	13.956
225	12.090	12.514	187.5	11.579		120	14.865	13.666	193.5	14.397	13.807
315	12.073	12.528	286.5	11.700	12.713	270		13.959	306	14.254	16.312

## DISCHARGE TOTAL TEMPERATURE

## STATION 2A

## PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	570.930	560.050	553.990	554.800	556.010
186	574.170	564.480	558.030	555.610	555.200
285	570.930	561.670	556.010	556.420	557.220
330		558.440	555.200		

## INLET TOTAL PRESSURE

## STATION 0

## PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	13.328	13.560	14.650	14.577	14.687
99	13.431	13.516	14.724	14.735	14.710
189	13.397	13.393	14.761	14.735	14.714
279	13.306	13.483	14.663	14.693	14.721

## DISCHARGE TOTAL PRESSURE

## STATION 2A

## PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
208.5	17.970		17.941		18.218
226.5		17.361		18.183	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	14.737	14.848	15.252	15.157	14.940	14.690	15.054	14.971	14.683

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{S} = 127.942$$

$$P_{2A}/P_0 = 1.1622$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 247.

CRUISE CONFIGURATION

70 % EQUIVALENT ROTOR SPEED

CIRC. WALL STATICS			CIRC.			CIRC.			CIRC.		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	14.249	14.298	3	14.125		10	*	14.833	45	16.157	15.610
135	14.241	14.293	102	14.112	14.201	94.5	16.014	14.869	99	15.935	15.612
225	14.229	14.297	187.5	14.114		180	15.724	14.880	193.5	15.868	15.629
315	14.241	14.298	295.5	14.105	14.220	270	15.899	14.861	306	15.921	15.711

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	552.930	548.150	541.360	538.950	538.550
186	553.230	549.350	542.560	539.360	537.750
235	552.540	548.150	543.760	540.560	540.160
330		543.750	539.360		

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.474	14.506	14.687	14.694	14.689
99	14.476	14.531	14.689	14.691	14.522
199	14.474	14.472	14.699	14.699	14.689
279	14.463	14.500	14.685	14.690	14.692

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
213.0	17.260		16.543		16.137
231.0		17.036		16.539	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.706	15.939	16.126	15.844	15.582	15.816	15.987	15.858	15.758



Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$W_{10}/S = 134.688$

$P_{14}/P_0 = 1.1568$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 248.

CRUISE CONFIGURATION

70% EQUIVALENT POS 1 4110

ALL STATICS

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	14.188	14.248	3	14.040		10	*	14.719	45	15.645	15.416
135	14.198	14.243	102	14.023	14.166	94.5	15.920	14.771	99	15.752	15.419
225	14.170	14.238	187.5	14.029		180	15.624	14.735	193.5	15.662	15.431
315	14.183	14.245	236.5	14.024	14.186	270	15.734	14.744	206	15.731	15.493

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
51	549.310	545.320	540.530	538.120	537.720
180	549.310	549.720	539.730	537.320	537.720
285	549.710	545.320	542.130	538.530	538.120
330		542.130	537.320		

INLET TOTAL PRESSURE  
STATION 0

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
9	14.446	14.483	14.533	14.697	14.695
99	14.457	14.513	14.696	14.699	14.698
189	14.451	14.452	14.699	14.700	14.698
279	14.437	14.469	14.689	14.692	14.692

DISCHARGE TOTAL PRESSURE  
STATION 2A

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
213.0	17.203		16.530		16.193
231.0		16.960		16.455	

* (DEGREES)	251	254	355.5	357	359	1.5	4	6	9
	15.600	15.301	16.051	15.746	15.512	15.848	15.848	15.783	15.667

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W/V/S = 193.535$$

$$P_{24}/P_0 = 1.1467$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 249.

CIRCUIT CONFIGURATION

70% EQUIVALENT ROTOR SPEED

WALL STATICS

CIRC. LOC. DEG.	STATION 0 TIP	HUB	CIRC. LOC. DEG.	STATION 1 TIP	HUB	CIRC. LOC. DEG.	STATION 2 TIP	HUB	CIRC. LOC. DEG.	STATION 2A TIP	HUB
45	14.118	14.214	3	13.934		10	*	14.538	45	15.375	15.054
135	14.125	14.211	102	13.965	14.074	94.5	15.715	14.631	99	15.439	15.052
225	14.117	14.204	187.5	13.973		180	15.469	14.559	193.5	15.373	15.060
315	14.125	14.204	286.5	13.950	14.094	270	15.530	14.564	306	15.423	15.135

DISCHARGE TOTAL TEMPERATURE

STATION 2A

CIRC. PERCENT SPAN FROM TIP

LOC. DEG.	10	30	50	70	90
51	546.120	542.920	538.910	536.080	536.490
186	548.510	544.720	538.910	536.080	536.890
285	547.710	544.120	541.720	538.500	538.100
330		541.320	537.700		

INLET TOTAL PRESSURE

STATION 0

CIRC. PERCENT SPAN FROM TIP

LOC. DEG.	10	30	50	70	90
9	14.353	14.431	14.691	14.679	14.688
99	14.437	14.501	14.688	14.703	14.704
189	14.443	14.433	14.714	14.707	14.700
279	14.408	14.451	14.696	14.696	14.703

DISCHARGE TOTAL PRESSURE

STATION 2A

CIRC. PERCENT SPAN FROM TIP

LOC. DEG.	10	30	50	70	90
213.0	17.072		16.409		16.097
231.0		16.735		16.303	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.438	15.596	15.899	15.558	15.360	15.519	15.681	15.599	15.503

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{S} = 157.557$$

$$P_{2A}/P_0 = 1.1152$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 245.

CRUISE CONFIGURATION

70% EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	13.982	14.084	3	13.774		10	*	14.116	45	14.874	14.154
135	14.004	14.094	102	13.786	13.928	94.5	15.224	14.230	99	14.696	14.153
225	13.987	14.086	187.5	13.606		180	15.073	14.157	193.5	14.627	14.240
315	13.986	14.082	266.5	13.731	13.942	270	15.039	14.202	306	14.698	14.344

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	541.620	537.790	534.560	531.720	532.130
186	541.020	539.810	534.160	531.320	532.530
285	542.620	539.410	536.180	533.350	532.530
330	536.580	536.580	532.530		

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.291	14.384	14.673	14.682	14.688
99	14.366	14.404	14.684	14.692	14.688
189	14.346	14.362	14.697	14.692	14.681
279	14.333	14.373	14.679	14.687	14.691

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
213.0	16.552		16.014		15.694
231.0		16.244		15.913	

\* (DEGREES) 351 354 250.5 257 359 1.5 4 6 9  
14.937 15.349 15.268 15.099 14.982 15.051 15.179 15.144 15.114

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

WV/S = 145.928

Pm/A = 1.2120

## 360 DEGREE RADIAL DISTORTION

POINT NUMBER 242.

## CRUISE CONFIGURATION

80% EQUIVALENT RATE: 100%

CIRC. LOC. DEG.			WALL STATICS			CIRC. LOC. DEG.			CIRC. LOC. DEG.		
STATION 0			STATION 1			STATION 2			STATION 2A		
TIP HUB			TIP HUB			TIP HUB			TIP HUB		
45	14.101	14.178	3	13.940		10	*	14.883	45	16.138	15.922
135	14.081	14.176	102	13.918	14.054	94.5	16.454	14.919	99	16.327	15.919
225	14.072	14.167	187.5	13.917		180	16.040	14.962	193.5	16.238	15.949
315	14.076	14.170	286.5	13.921	14.071	270	16.273	14.948	306	16.288	15.921

## DISCHARGE TOTAL TEMPERATURE

## STATION 2A

## PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	562.240	555.080	547.500	543.500	543.500
186	562.640	557.070	548.290	544.300	541.890
285	563.040	555.080	548.290	544.300	544.300
330			544.300		

## INLET TOTAL PRESSURE

## STATION 0

## PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.364	14.428	14.686	14.680	14.681
99	14.415	14.450	14.687	14.687	14.696
189	14.406	14.410	14.702	14.686	14.689
279	14.387	14.423	14.684	14.689	14.682

## DISCHARGE TOTAL PRESSURE

## STATION 2A

## PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
213.0	18.056		17.239		16.506
231.0		17.788		17.104	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	16.009	16.326	16.673	16.239	15.864	16.151	16.395	16.227	16.044

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{G} = 152.741$$

$$P_{2A}/P_0 = 1.2105$$

360° DEGREE RADIAL DISTORTION

POINT NUMBER 243.

CRUISE CONFIGURATION

60° EQUIVALENT ROTOR SPEED

CIRC.			CIRC.			WALL STATICS			CIRC.			CIRC.		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	14.347	14.121	3	13.866		10	*	14.760	45	15.975	15.742			
125	14.355	14.115	102	13.841	13.992	94.5	16.363	14.817	99	16.173	15.733			
225	14.329	14.111	197.5	13.852		180	15.953	14.815	193.5	16.060	15.757			
315	14.031	14.118	286.5	13.844	14.011	270	16.137	14.801	306	16.159	15.852			

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	559.310	553.740	547.350	542.550	542.950
186	559.710	555.330	546.950	542.950	542.150
285	560.500	553.340	548.150	543.350	543.750
330		548.950	543.350		

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.337	14.413	14.686	14.681	14.695
99	14.386	14.429	14.690	14.672	14.687
189	14.376	14.380	14.708	14.700	14.692
279	14.358	14.407	14.699	14.689	14.699

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
213.0	18.020		17.202		16.575
231.0		17.706		17.018	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.906	16.209	16.499	16.133	15.813	16.087	16.300	16.182	15.965

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{E}/S = 163.199$$

$$P_{2A}/P_0 = 1.1762$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 244.

CRUISE CONFIGURATION

80% EQUIVALENT ROTOR EFFICIENCY

CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	13.923	14.033	3	13.675		10	*	14.481	45	15.610	15.222
135	13.931	14.027	102	13.700	13.882	94.5	16.031	14.593	99	15.695	15.220
225	13.931	14.031	187.5	13.687		180	15.710	14.523	193.5	15.596	15.230
315	13.923	14.035	286.5	13.676	13.903	270	15.788	14.524	306	15.686	15.354

## DISCHARGE TOTAL TEMPERATURE

## STATION 2A

## PERCENT SPAN FROM TIP

CIRC.	LOC.	DEG.	10	30	50	70	90
51	554.210		549.820	544.230	541.020	541.020	
86	555.200		551.020	543.830	540.210	541.820	
185	556.600		551.820	547.420	542.220	541.420	
30			547.820	543.430			

## INLET TOTAL PRESSURE

## STATION 0

## PERCENT SPAN FROM TIP

CIRC.	LOC.	DEG.	10	30	50	70	90
9	14.289		14.385	14.687	14.677	14.674	
99	14.335		14.377	14.683	14.694	14.685	
189	14.313		14.328	14.696	14.686	14.682	
279	14.305		14.355	14.681	14.681	14.693	

## DISCHARGE TOTAL PRESSURE

## STATION 2A

## PERCENT SPAN FROM TIP

CIRC.	LOC.	DEG.	10	30	50	70	90
213.0			17.849		16.944	0.000	16.518
231.0				17.408		16.807	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.623	15.874	16.223	15.874	15.599	15.738	15.996	15.915	15.721

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

 $W\sqrt{S} = 179717$  $P_{2A}/P_0 = 1.1577$ 

360 DEGREE RADIAL DISTORTION

POINT NUMBER 240.

CRUISE CONFIGURATION

80 % EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	13.751	13.879	3	13.421		10	*	13.921	45	14.868	14.013
135	13.770	13.884	102	13.465	13.666	94.5	15.427	14.068	99	14.703	13.970
225	13.741	13.865	187.5	13.479		180	15.203	13.990	193.5	14.573	14.080
315	13.745	13.869	286.5	13.401	13.686	270	15.124	14.013	306	14.671	14.216

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
51	542.170	543.560	539.130	536.700	535.480
186	548.310	546.770	540.340	535.080	535.890
285	549.970	545.570	541.950	537.510	536.700
330		541.950			

INLET TOTAL PRESSURE  
STATION 0

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
9	14.159	14.267	14.675	14.567	14.678
99	14.247	14.289	14.682	14.692	14.673
189	14.230	14.238	14.701	14.693	14.694
279	14.221	14.274	14.687	14.694	14.701

DISCHARGE TOTAL PRESSURE  
STATION 2A

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
213.0	17.234		16.488		15.992
231.0		16.766		16.301	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.067	15.181	15.248	15.327	15.151	15.171	15.214	15.267	15.138

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{S} = 170.760$$

$$P_{2A}/P_0 = 1.3597$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 237.

CRUISE CONFIGURATION

100% EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	13.588	13.775	3	13.174		10	*	14.872	45	17.107	16.476
135	13.583	13.777	102	13.169	13.574	24.5	17.569	14.894	99	17.119	16.488
225	13.561	13.756	187.5	13.155		180	16.826	15.043	193.5	16.974	16.534
315	13.586	13.766	286.5	13.155	13.614	270	17.097	15.021	306	17.071	16.618

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
51	577.890	577.050		558.480	555.670
186		579.580	564.470	558.880	554.870
285	577.470	575.390	567.270	559.680	558.480
330					

INLET TOTAL PRESSURE  
STATION 0

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
9	14.135	14.232	14.675	14.687	14.693
99	14.194	14.257	14.700	14.708	14.701
189	14.160	14.168	14.709	14.708	14.704
279	14.139	14.197	14.700	14.704	14.713

DISCHARGE TOTAL PRESSURE  
STATION 2A

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
213.0	20.365		18.790		17.395
231.0		19.781		18.441	

* (DEGREES)	351.	354	355.5	357	359	1.5.	4	6	9
	16.749	17.344	17.698	17.229	16.513	16.970	17.461	17.288	17.026



Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{S} = 172.640$$

$$P_{2A}/P_0 = 1.3502$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 238.

CRUISE CONFIGURATION

100 % EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	13.516	13.729	3	13.038		10	*	14.672	45	16.860	16.272
135	13.533	13.728	102	13.060	13.535	94.5	17.482	14.760	99	16.919	16.289
225	13.481	13.704	197.5	13.071		180	16.681	14.788	193.5	16.727	16.313
315	13.509	13.704	286.5	13.095	13.565	270	16.875	14.780	306	16.889	16.392

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51		571.140	559.930	553.940	553.540
186	588.390	574.830	561.520	554.740	553.140
295	583.000	573.190	566.310	558.730	557.930
330					

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.139	14.230	14.661	14.687	14.698
99	14.165	14.213	14.701	14.711	14.714
199	14.130	14.143	14.715	14.705	14.709
279	14.104	14.184	14.683	14.692	14.697

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
213.0	20.247		18.655		17.544
231.0		19.655		18.353	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	16.619	17.088	17.588	17.059	16.417	16.796	17.295	17.178	16.718

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

 $W\sqrt{E}/S = 206.580$  $P_{2A}/P_0 = 1.3204$ 

360 DEGREE RADIAL DISTORTION

POINT NUMBER 239.

CRUISE CONFIGURATION

100% EQUIVALENT ROTOR SPECIC

CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	13.441	13.637	3	12.947		10	*	14.290	45	16.225	15.606
135	13.432	13.650	102	12.948	13.371	94.5	17.010	14.499	99	16.334	15.593
225	13.428	13.628	197.5	12.977		180	16.335	14.390	193.5	16.113	15.604
315	13.435	13.635	286.5	12.919	13.415	270	16.402	14.420	306	16.312	15.815

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
51		568.140	560.150	552.960	552.560
186	582.460	571.370	558.950	553.360	555.360
285	578.850	571.780	564.140	555.760	554.560
330					

INLET TOTAL PRESSURE  
STATION 0

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
9	14.027	14.109	14.648	14.689	14.687
99	14.104	14.197	14.716	14.684	14.715
189	14.084	14.070	14.740	14.731	14.721
279	14.063	14.154	14.709	14.708	14.729

DISCHARGE TOTAL PRESSURE  
STATION 2A

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
213.0	19.840		18.349		17.516
231.0		19.120		18.024	

\* (DEGREES) 351 354 355.5 357 359 1.5 4 6 9

16.194 16.647 17.129 16.556 16.175 16.411 16.899 16.781 16.356

Table B-1. Basic Distortion Data 360-Degree Radial Distortion (Continued)

$$W\sqrt{S} = 221.680$$

$$P_{1A}/P_0 = 1.2568$$

360 DEGREE RADIAL DISTORTION

POINT NUMBER 235.

CRUISE CONFIGURATION

100% EQUIVALENT ROTOR SPEED

WALL STATICS

CIRC. LOC. DEG.	STATION 0 TIP HUB	CIRC. LOC. DEG.	STATION 1 TIP HUB	CIRC. LOC. DEG.	STATION 2 TIP HUB	CIRC. LOC. DEG.	STATION 2A TIP HUB
45	13.139 13.403	3	12.550	10	* 13.451	45	14.660 13.673
135	13.172 13.437	102	12.636 13.029	94.5	15.888 13.645	99	14.715 13.673
225	13.126 13.400	187.5	12.643	180	15.538 13.601	193.5	14.528 13.823
315	13.143 13.400	285.5	12.587 13.070	270	15.384 13.683	301	14.659 14.004

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	566.540	558.560	551.760	546.150	544.140
136	567.340	562.540	552.560	545.750	544.950
285	568.950	560.950	554.560	548.150	545.350
330		555.760			

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	13.891	14.009	14.654	14.702	14.699
99	13.985	14.039	14.709	14.710	14.689
189	13.936	13.965	14.732	14.706	14.712
279	13.905	14.006	14.711	14.707	14.715

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
213.0	18.815		17.601		16.702
231.0		18.105		17.222	

\* (DEGREES) 351 354 355.5 357 359 1.5 4 6 9  
15.343 15.504 15.804 15.685 15.405 15.467 15.710 15.819 15.547

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion

$$W\sqrt{S} = 151.181$$

$$A_n/A_0 = 1.175$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 293.

SLT0 CONFIGURATION

70 % EQUIVALENT LATCH TYPED

CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	14.105	14.156	3	13.788		10	*	15.571	45	16.218	15.567
135	14.178	14.236	102	14.220	14.308	94.5	16.298	15.231	99	16.107	15.953
225	14.113	14.237	187.5	14.002		180	16.031	15.234	193.5	16.198	15.952
315	14.012	14.105	285.5	13.960	14.238	270	16.077	15.315	306	16.125	15.706

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

CIRC. WALL STATICS		PERCENT SPAN FROM TIP				
LOC.		10	30	50	70	90
DEG.						
51	500.829	505.222	500.791	546.337	541.452	
183	550.386	547.054	544.306	541.861	543.084	
285	546.743	546.743	543.193	542.075	542.076	
330						

INLET TOTAL PRESSURE  
STATION 0

CIRC. WALL STATICS		PERCENT SPAN FROM TIP				
LOC.		10	30	50	70	90
DEG.						
9	14.340	14.361	14.293	14.265	14.388	
99	14.387	14.704	14.701	14.705	14.712	
189	14.709	14.705	14.707	14.702	14.699	
279	14.686	14.690	14.693	14.701	14.698	

DISCHARGE TOTAL PRESSURE  
STATION 2A

CIRC. WALL STATICS		PERCENT SPAN FROM TIP				
LOC.		10	30	50	70	90
DEG.						
42.5	17.379	17.129	16.754	16.550	16.368	
204.5	17.579		17.166		16.922	
226.5		17.427		16.953		

* (DECKLETS)	351	354	353.3	357	359	1.5	4	6	9
	16.115	16.298	16.354	16.470	16.091	16.194	16.373	16.351	16.107

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W_{\text{AVE}} = 160.324$$

$$A_{2A}/A_0 = 1.172$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 296.

SLT0 CONFIGURATION

70% EQUIVALENT ROTOR SPEED

WALL STATICS

CIRC. LOC. DEG.	STATION C		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	15.970	14.085	3	13.899		10	*	15.278	45	16.084	15.845
135	14.087	14.191	102	14.052	14.223	94.5	16.172	15.128	99	16.095	15.823
225	14.055	14.154	187.5	13.915		180	15.963	15.154	190.5	16.031	15.821
315	13.937	14.051	286.5	12.871	14.189	270	15.877	15.245	305	15.954	15.512

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
51	557.694	554.076	549.229	545.575	524.572
186	549.229	545.981	543.948	541.697	542.314
205	548.417	545.158	543.538	541.497	542.314
330					

INLET TOTAL PRESSURE  
STATION C

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
9	14.291	14.322	14.553	14.294	14.337
99	14.513	14.690	14.709	14.697	14.699
189	14.710	14.710	14.712	14.701	14.691
279	14.675	14.689	14.695	14.692	14.704

DISCHARGE TOTAL PRESSURE  
STATION 2A

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
42.5	17.320	17.351	17.740	16.430	16.305
208.5	17.457		17.140		16.961
226.5		17.340		16.947	

W (POUNDS)	331	334	335.5	337	359	1.0	4	6	9
	15.947	15.140	16.203	16.107	15.930	16.055	16.238	16.178	15.913

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

 $W/S = 180.243$  $P_{2A}/P_0 = 4.57$ 

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 299.

SLTO CONFIGURATION

70 % EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB	TIP	HUB		TIP	HUB
45	13.724	13.925	3	13.460		10	*	45	15.673	15.467
135	13.938	14.244	102	13.824	14.069	94.5	15.834	99	15.676	15.427
225	13.928	14.037	187.5	13.785		180	15.731	193.5	15.596	15.397
315	13.800	13.892	285.5	13.763	14.074	270	15.551	306	15.251	15.027

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	551.194	548.769	545.931	542.676	520.794
186	545.525	542.084	541.044	539.409	539.818
285	545.119	543.084	540.536	539.818	539.818
330					

## INLET TOTAL PRESSURE

STATION 0.

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.173	14.249	14.242	14.213	14.227
99	14.701	14.715	14.713	14.727	14.718
189	14.701	14.714	14.707	14.704	14.707
279	14.692	14.695	14.690	14.704	14.700

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	17.061	16.852	16.577	16.327	16.225
208.5	17.197		16.999		16.793
225.5		17.099		16.828	

# (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.584	15.714	15.826	15.815	15.656	15.669	15.807	15.814	15.592

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W\sqrt{E}/S = 204.457$$

$$P_a/P_b = 1.121$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 299.

SLT0 CONFIGURATION

70 % EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	13.377	13.530	3	13.104		10	*	14.114	45	14.720	14.705
135	13.691	13.593	102	13.531	13.800	94.5	13.098	14.297	99	14.034	14.770
225	13.658	13.826	137.5	13.521		180	14.979	14.292	193.5	14.499	14.249
315	13.506	13.658	200.5	13.513	13.819	270	14.932	14.413	300	14.519	14.857

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51					
125		**			
245					
330					

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
3	13.217	14.048	14.079	14.062	13.913
99	14.705	14.723	14.724	14.711	14.722
109	14.717	14.719	14.720	14.709	14.709
279	14.730	14.695	14.704	14.712	14.716

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	15.335	15.167	15.111	15.864	15.747
200.5	16.422		15.486		15.520
220.5		16.453		15.523	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	14.388	14.955	15.016	15.041	14.905	14.925	15.005	15.037	14.837

\*\* Faulty Temperature Data; Efficiency Calculated From Extrapolated Temperature Data

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

 $W/V/S = 163.415$  $P_{20}/P_0 = 1.232$ 

90 DEGREE CIRCUMFERENTIAL DISTORTION:

POINT NUMBER 306.

SKTD CONFIGURATION

80 % EQUIVALENT ROTOR SPEED

CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	14.001	14.057	3	13.503		10	*	15.819	45	16.756	16.443
135	14.151	14.236	102	14.302	14.231	94.5	17.027	15.447	99	16.663	16.349
225	13.990	14.097	187.5	13.885		160	16.270	15.433	193.5	16.741	16.467
315	13.833	13.961	286.5	13.729	14.105	270	16.607	15.533	306	16.624	16.111

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	575.995	568.879	558.906	555.287	555.287
185	563.707	556.896	552.867	549.224	551.250
285	559.707	556.093	551.655	550.844	550.035
330					

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.232	14.228	14.286	14.247	14.275
99	14.699	14.704	14.706	14.711	14.707
189	14.706	14.715	14.715	14.709	14.700
279	14.692	14.703	14.697	14.710	14.710

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	16.311	17.979	17.403	17.100	16.748
209.5	16.447		17.952		17.649
226.5		16.299		17.678	

* (DEGREES)	331	354	255.5	357	359	1.5	4	6	9
	16.704	16.952	17.007	17.040	16.663	16.797	17.086	17.056	16.649



Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$\overline{W\sqrt{e}/S} = 180.565$$

$$P_{2,2}/P_0 = 1.231$$

### 90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 309.

SLTD C0N116VRF:17W

80 % EQUIVALENT ROTOR SPEED

CIRC.			WALL			STATICS			CIRC.		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	13.786	13.896	3	13.363		10	*	15.582	45	16.565	16.254
125	13.949	14.055	102	13.928	14.110	94.5	16.634	15.291	99	16.539	16.255
225	13.847	13.950	187.5	13.658		180	16.418	15.315	193.5	16.498	16.240
315	13.720	13.828	284.5	13.635	14.034	270	16.425	15.433	306	16.423	15.849

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC.		PERCENT SPAN FROM TIP				
LOC.						
DEG.	10	30	50	70	90	
51	570.546	564.976	558.971	553.329	552.520	
186	556.959	554.137	550.495	544.837	543.465	
285	556.557	553.329	548.058	547.651	548.465	
330						

## INLET TOTAL PRESSURE

STATION 3

PERCENT SPAN FROM TIP

CIRC.	PERCENT SPAN FROM TIP				
LOC.					
DEG.	10	20	50	70	90
9	14.162	14.206	14.222	14.195	14.228
99	14.706	14.715	14.713	14.712	14.711
189	14.708	14.714	14.714	14.709	14.700
279	14.687	14.696	14.692	14.691	14.693

## DISCHARGE TOTAL PRESSION

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	19.227	17.864	17.338	17.012	16.777
208.5	19.492		17.933		17.535
226.5		19.240		17.671	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	16.452	16.656	16.754	16.777	16.443	16.548	16.821	16.833	16.427

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W/\sqrt{S} = 200.727$$

$$P_a/P_0 = 1.227$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 312.

SLT0 CONFIGURATION

80% EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.			CIRC. LOC. DEG.			CIRC. LOC. DEG.			CIRC. LOC. DEG.		
STATION 0			STATION 1			STATION 2			STATION 2A		
TIP HUB			TIP HUB			TIP HUB			TIP HUB		
45	12.475	13.588	3	13.074		10	*	15.100	45	16.202	15.901
135	12.730	13.846	102	13.556	13.909	94.5	16.417	15.014	99	16.187	15.855
225	12.689	13.820	187.5	13.453		180	16.166	15.075	193.5	16.092	15.817
315	12.512	12.630	266.5	13.444	13.956	270	16.149	15.205	306	16.001	15.356

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
51	564.862	562.356	555.581	552.735	552.735
186	555.986	552.328	549.879	547.835	547.835
285	555.581	551.511	549.879	547.835	547.835
330					

INLET TOTAL PRESSURE  
STATION 0

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
9	14.010	14.075	14.092	14.058	14.082
90	14.697	14.709	14.707	14.705	14.713
189	14.710	14.718	14.709	14.710	14.701
279	14.682	14.688	14.687	14.698	14.700

DISCHARGE TOTAL PRESSURE  
STATION 2A

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
42.5	18.049	17.730	17.271	16.867	16.654
208.5	18.222		17.831		17.539
226.5		17.995		17.594	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	16.069	16.262	16.382	16.423	16.149	16.220	16.419	16.412	16.098

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W\sqrt{S} = 229.474$$

$$P_{in}/P_0 = 1.163$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 302.

SLIT CONFIGURATION

80% EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	12.923	12.109	3	12.549		10	*	13.902	45	14.715	14.497
135	13.377	13.360	102	13.174	13.536	94.5	15.237	14.213	99	14.627	14.378
225	13.300	13.359	137.5	13.161		130	15.096	14.152	193.5	14.429	14.111
315	13.130	12.321	296.5	13.114	13.545	270	14.971	14.350	306	14.439	13.803

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	544.884	550.844	544.344	546.788	548.007
186	545.160	542.711	543.120	542.302	542.711
285	545.160	543.120	542.711	543.120	543.120
330					

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
8	13.729	13.805	13.853	13.929	13.829
90	14.600	14.591	14.718	14.541	14.730
180	14.721	14.731	14.722	14.705	14.720
270	14.682	14.706	14.698	14.696	14.706

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	16.824	16.615	16.565	16.154	16.002
208.5	16.979		17.007		17.007
226.5		16.971		17.056	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	14.945	15.022	15.142	15.153	15.036	14.993	15.119	15.117	14.892

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W\sqrt{E/S} = 212.396$$

$$P_{12}/P_0 = 1.377$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 330.

SLT0 CONFIGURATION

ICEE EQUIVALENT

ROTOR SPEED

WALL STATICS

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	13.498	13.577	3	12.412		10	*	16.524	45	17.841	17.319
135	13.741	13.861	102	13.894	13.935	24.5	18.259	15.792	99	17.567	17.188
225	13.365	13.535	187.5	13.033		190	17.203	15.718	193.5	17.829	17.372
315	13.123	13.328	226.5	12.181	13.620	270	17.756	15.904	306	17.809	16.343

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
51	606.727	595.598	583.103	576.398	579.558
126	584.671	575.606	568.048	566.049	567.649
255	585.076	574.313	569.245	566.449	565.649
320					

INLET TOTAL PRESSURE  
STATION 0

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
9	13.907	13.920	13.977	13.913	13.970
99	14.602	14.698	14.704	14.703	14.712
189	14.721	14.711	14.721	14.721	14.720
279	14.650	14.692	14.692	14.705	14.700

DISCHARGE TOTAL PRESSURE  
STATION 2A

CIRC. LOC. DEG.	PERCENT SPAN FROM TIP				
	10	30	50	70	90
42.5	20.555	19.807	19.876	18.193	17.538
207.5	21.150		19.935		19.195
226.5		20.491		19.446	

* (DEGREES)	311	334	353.5	357	359	1.5	4	6	9
	17.739	18.362	18.607	18.506	17.830	18.094	18.592	18.591	18.077

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W\sqrt{g}/S = 238.635$$

$$P_{2A}/P_0 = 1.366$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 326.

SATS CONFIGURATION

100 % EQUIVALENT SECTION SPEED

CIRC. LOC. DEG.			WALL STATICS			CIRC. LOC. DEG.			CIRC. LOC. DEG.		
STATION 0			STATION 1			STATION 2			STATION 2A		
TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB	
45	12.965	13.149	3	12.180		10	*	15.912	45	17.464	16.870
135	13.262	13.462	102	13.052	13.567	94.5	17.707	15.380	99	17.417	16.913
225	13.131	13.359	197.5	12.755	-	180	17.242	15.407	193.5	17.270	16.807
315	12.914	13.092	216.5	12.740	13.422	270	17.234	15.682	306	17.205	16.142

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	599.794	599.309	579.104	572.372	572.769
186	579.393	571.179	565.189	561.979	563.586
295	561.075	570.392	567.190	562.783	565.189
330					

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	13.704	13.784	13.793	13.753	13.798
99	14.625	14.711	14.701	14.713	14.713
189	14.706	14.724	14.714	14.724	14.707
279	14.662	14.671	14.697	14.695	14.708

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	20.039	19.505	19.741	18.250	17.522
203.5	20.663		19.769		19.119
226.5		20.033		19.351	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	17.280	17.710	18.003	17.849	17.260	17.474	17.881	17.921	17.307



Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

 $W/E/S = 273.421$  $P_{1A}/P_0 = 1.237$ 

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 320.

SLT0 CONFIGURATION

100% EQUIVALENT REFINEMENT

CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	11.870	12.126	3	11.418		10	*	13.397	45	14.755	14.247
135	12.792	12.992	102	12.474	12.866	94.5	15.341	14.011	99	14.550	14.103
225	12.751	12.996	197.5	12.490		180	15.122	13.941	193.5	14.251	13.756
315	12.415	12.635	296.7	12.486	12.878	270	15.065	15.098	306	14.280	12.893

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
51	577.658	558.163	555.375	551.777	558.971
135	552.570	555.751	555.751	554.341	555.751
225	552.178		556.557	556.959	557.361
315					

INLET TOTAL PRESSURE  
STATION 0

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
9	13.182	13.306	13.342	13.341	13.342
99	14.659	14.710	14.710	14.714	14.727
189	14.742	14.742	14.727	14.719	14.705
279	14.637	14.657	14.683	14.707	14.700

DISCHARGE TOTAL PRESSURE  
STATION 2A

PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
42.5	17.721	17.349	17.468	16.953	16.542
209.5	17.938		18.043		18.318
226.5		17.627		18.346	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	14.929	15.076	15.480	15.273	14.967	15.033	15.113	15.209	14.709

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W\sqrt{S} = 123.676$$

$$P_{01}/P_0 = 1.150$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 280.

CRUISE CONFIGURATION

70 % EQUIVALENT ROTOR SPEED

CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	14.234	14.303	3	14.056		10	*	14.995	45	15.953	15.637
135	14.376	14.396	102	14.351	14.291	94.5	16.134	14.877	99	15.976	15.689
225	14.322	14.366	187.5	14.219		180	15.708	14.871	193.5	15.839	15.598
315	14.270	14.315	285.5	14.123	14.246	270	15.893	14.923	306	15.932	15.675

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	512.130	530.409	545.210	540.283	538.767
185	540.013	546.012	540.735	537.959	536.744
205	547.614	546.813	541.994	539.171	539.171
330					

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.440	14.483	14.479	14.472	14.481
99	14.604	14.688	14.633	14.607	14.694
189	14.690	14.705	14.698	14.690	14.683
279	14.696	14.692	14.690	14.691	14.700

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	17.300	17.019	16.748	16.011	15.730
213.0	17.192		16.647		16.248
231.0		17.043		16.608	

* (DEGREES)	231	334	353.5	357	359	1.5	4	6	9
	15.107	15.999	16.065	15.939	15.725	15.898	16.080	15.969	15.861



Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W\sqrt{E/S} = 133.653$$

$$P_{2A}/P_0 = 1.145$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 283.

CRUISE CONFIGURATION

70% EQUIVALENT ENGINE SPEED

ALL STATICS

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	14.185	14.211	3	13.959		10	*	14.741	45	15.800	15.490
135	14.305	14.332	102	14.136	14.213	94.5	15.924	14.801	99	15.772	15.453
225	14.277	14.330	187.5	14.157		180	15.678	14.777	193.5	15.660	15.428
315	14.221	14.254	286.5	14.125	14.200	270	15.768	14.783	306	15.728	15.514

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	549.383	548.286	542.686	539.471	537.859
136	545.891	544.291	539.974	536.647	536.243
285	545.491	544.690	541.884	538.262	537.859
330					

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.420	14.445	14.452	14.443	14.448
99	14.503	14.635	14.635	14.690	14.687
189	14.696	14.699	14.700	14.691	14.687
273	14.577	14.689	14.689	14.689	14.688

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	17.238	16.926	16.630	16.365	15.679
213.0	17.128		16.579		15.270
231.0		16.965		16.512	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.675	15.864	15.910	15.802	15.585	15.757	15.912	15.838	15.695

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

 $W\sqrt{E/S} = 142.376$  $P_{20}/P_0 = 1.137$ 

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 286.

CRUISE CONFIGURATION

70 % EQUIVALENT ROTOR SPEED

WALL - STATICS

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	14.097	14.150	3	13.913		10	*	14.536	45	15.559	15.246
135	14.256	14.317	102	14.099	14.154	94.5	15.912	14.706	99	15.519	15.168
225	14.254	14.310	187.5	14.110		180	15.586	14.670	193.5	15.439	15.163
315	14.181	14.233	286.5	14.077	14.151	270	15.611	14.675	306	15.511	15.324

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	547.614	546.813	542.800	539.576	538.363
186	545.210	543.603	539.979	537.554	537.554
285	545.210	543.202	541.199	537.959	537.959
330					

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.388	14.431	14.426	14.408	14.415
99	14.390	14.698	14.696	14.702	14.700
139	14.712	14.708	14.704	14.695	14.695
279	14.637	14.697	14.693	14.701	14.702

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	17.159	16.820	16.429	16.251	15.869
213.0	17.014		16.516		16.190
231.0		16.825		16.415	

* (DEGREES)	351	354	355.5	357	359	1.5	4	9	
	15.494	15.576	15.736	15.661	15.438	15.590	15.736	15.676	15.532

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W\sqrt{E/S} = 159.509$$

$$P_{2A}/P_0 = 1.102$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 276.

CRUISE CONFIGURATION

70% EQUIVALENT REACH SPEED

WALL STATICS

CIRC. LOC. DEG.	STATION 0 TIP	HUB	CIRC. LOC. DEG.	STATION 1 TIP	HUB	CIRC. LOC. DEG.	STATION 2 TIP	HUB	CIRC. LOC. DEG.	STATION 2A TIP	HUB
45	14.920	13.966	3	13.968		10	*	14.089	45	14.652	14.273
135	14.110	14.198	102	13.924	13.998	94.5	15.258	14.284	99	14.665	14.100
225	14.127	14.108	137.5	13.964		180	15.099	14.225	193.5	14.587	14.186
315	14.048	14.072	266.5	13.921	14.002	270	15.047	14.309	306	14.658	14.323

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	542.449	540.024	537.998	535.561	538.404
186	536.404	533.781	534.140	532.502	532.709
285	537.187	537.187	535.531	533.525	533.525
330					

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.226	14.640	14.333	14.327	14.325
99	14.324	14.701	14.700	14.692	14.707
189	14.707	14.714	14.709	14.707	14.694
279	14.691	14.688	14.691	14.701	14.697

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	15.488	15.169	15.953	15.739	15.484
213.0	16.404		16.101		15.765
231.0		16.293		16.707	

# (DEGREES)	351	354	355.5	357	359	1.5	4		
	14.915	15.010	15.050	15.057	14.938	14.996	15.102	15.106	14.999

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W/V/S = 143.648$$

$$P_{2A}/A = 1.178$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 257.

CRUISE CONFIGURATION

80% EQUIVALENT ROTOR SPEED

ALL STATICS

CIRC. LOC. DEG.	STATION 0 TIP	HUB	CIRC. LOC. DEG.	STATION 1 TIP	HUB	CIRC. LOC. DEG.	STATION 2 TIP	HUB	CIRC. LOC. DEG.	STATION 2A TIP	HUB
45	14.133	14.174	3	13.806		10	*	15.056	45	16.305	15.879
135	14.262	14.319	102	14.261	14.176	94.5	16.560	14.894	99	16.354	15.939
225	14.182	14.264	197.5	14.044		180	15.979	14.896	193.5	16.139	15.836
315	14.127	14.189	283.5	13.608	14.105	270	16.217	14.990	306	16.217	15.921

DISCHARGE TOTAL TEMPERATURE  
STATION 2A

CIRC. LOC. DEG.	10	30	50	70	90
51	562.033	558.284	552.231	544.513	543.307
106	559.279	557.295	547.853	542.997	542.184
230	556.308	552.221	549.405	545.023	545.023
320					

INLET TOTAL PRESSURE  
STATION 0

CIRC. LOC. DEG.	10	30	50	70	90
9	14.379	14.383	14.409	14.395	14.408
99	14.696	14.695	14.697	14.703	14.704
183	14.706	14.715	14.716	14.701	14.697
279	14.697	14.703	14.693	14.695	14.706

DISCHARGE TOTAL PRESSURE  
STATION 2A

CIRC. LOC. DEG.	10	30	50	70	90
42.5	17.251	17.774	17.360	16.278	15.987
213.0	17.960		17.260		16.732
231.0		17.816		17.143	

* (DEGREES)	251	354	355.5	357	359	1.5	4	6	9
	16.112	16.361	16.392	16.357	16.037	16.242	16.499	16.369	16.182

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W\sqrt{E/S} = 151.692$$

$$P_{EA}/P_0 = 1.194$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 270.

CRUISE CONFIGURATION

80% EQUIVALENT POWER SPEED

CIRC. LOC. DEG. STATION 0			CIRC. LOC. DEG. STATION 1			CIRC. LOC. DEG. STATION 2			CIRC. LOC. DEG. STATION 2A		
TIP HUB			TIP HUB			TIP HUB			TIP HUB		
45	14.042	14.077	3	13.739		10	*	14.848	45	16.136	15.754
135	14.172	14.233	102	14.048	14.082	94.5	16.311	14.804	99	16.124	15.714
225	14.152	14.216	187.5	13.982		180	15.978	14.807	193.5	15.974	15.661
315	14.090	14.136	285.5	12.941	14.064	270	16.090	14.792	306	16.052	15.705

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	559.409	558.612	551.015	546.990	544.971
186	555.022	552.219	546.586	542.135	541.729
285	550.212	548.199	547.796	543.756	543.756
330					

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.340	14.369	14.390	14.361	14.371
99	14.689	14.697	14.694	14.694	14.691
189	14.731	14.703	14.709	14.702	14.691
279	14.692	14.681	14.697	14.698	14.692

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	13.143	17.675	17.289	16.558	15.925
213.0	17.139		17.232		15.728
231.0		17.734		17.054	

* (DEGREES)	051	354	205.5	357	359	1.5	4	6	9
	15.984	15.223	18.322	16.205	13.904	15.103	16.348	16.251	16.052

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W/V/S = 163.837$$

$$P_{20}/P_0 = 1.174$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 273.

CRUISE CONFIGURATION

80 % EFFICIENCY PUMP SPEED

ALL STATICS

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB
45	13.903	13.919	5	13.581		10	*	14.384	45	15.084	15.260
135	14.119	14.136	102	13.835	13.907	94.5	13.035	14.621	99	15.604	15.154
225	14.104	14.140	187.5	13.890		180	15.779	14.534	193.5	15.129	15.146
315	14.009	14.051	286.5	13.856	13.973	270	15.786	14.590	306	15.505	15.278

DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	554.879	532.584	540.433	540.059	542.444
105	551.686	543.082	544.059	540.827	541.232
250	548.433	547.271	545.475	542.040	541.232
330					

INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.285	14.299	14.316	14.298	14.311
99	14.701	14.701	14.708	14.708	14.693
189	14.717	14.707	14.713	14.709	14.703
279	14.609	14.605	14.575	14.709	14.713

DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	17.308	17.342	16.905	16.669	16.176
213.0	17.619		16.992		16.574
231.0		17.387		16.872	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.618	15.846	15.921	15.840	15.559	15.730	15.921	15.894	15.685

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

 $W\sqrt{E}/S = 180.057$  $P_{2A}/P_0 = 1.139$ 

90 DEGREE CIRCUMFERENCE DISTORTION

POINT NUMBER 263.

CRUISE CONFIGURATION

80 % EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		WALL STATICS		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB				TIP	HUB		TIP	HUB
45	13.648	13.737	3	13.299				10	*	13.745	45	14.641	14.135
135	13.938	14.039	102	13.662	13.774			94.5	15.418	14.132	99	14.636	13.923
225	13.935	14.037	187.5	13.710				180	15.237	14.076	193.5	14.503	14.005
315	13.816	13.892	286.5	13.638	13.774			270	15.160	14.147	306	14.580	14.100

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	549.275	546.022	544.390	540.707	541.527
186	545.207	543.164	539.065	536.596	537.419
285	545.207	543.164	541.527	537.831	537.419
330					

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	20	50	70	90
9	14.138	14.222	14.206	14.209	14.225
99	14.681	14.584	14.689	14.691	14.596
189	14.679	14.704	14.701	14.690	14.675
279	14.669	14.670	14.678	14.691	14.686

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	20	50	70	90
42.5	17.027	16.607	15.365	16.036	15.685
213.0	17.126		16.588		16.092
231.0		16.220		16.378	

* (DEGREES)	251	254	255.5	257	259	1.5	4	6	9
	14.959	15.094	15.131	15.152	14.981	15.047	15.206	15.231	15.060

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W/E/S = 180.848$$

$$P_{2M}/P_0 = 1.324$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 254.

CRUISE CONFIGURATION

100 % EQUIVALENT ROTOR SPEED

CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS			CIRC. WALL STATICS		
LOC.	STATION 0		LOC.	STATION 1		LOC.	STATION 2		LOC.	STATION 2A	
DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB	DEG.	TIP	HUB
45	13.802	13.841	3	13.078		10	*	15.554	45	17.210	16.495
135	14.005	14.065	102	13.929	13.888	94.5	17.748	14.975	99	17.196	16.595
225	13.829	13.937	187.5	13.485		180	16.636	14.915	193.5	16.900	16.457
315	13.734	13.815	286.5	13.378	13.724	270	17.112	15.095	306	17.087	16.674

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	591.945	583.576	573.514	562.115	561.296
186	582.374	575.131	563.753	558.009	555.949
285	575.938	568.646	566.610	560.475	559.653
330					

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.167	14.240	14.214	14.188	14.222
99	14.690	14.704	14.710	14.701	14.704
189	14.716	14.709	14.712	14.711	14.694
279	14.681	14.690	14.698	14.707	14.704

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	20.861	19.900	18.711	16.908	16.658
213.0	20.056		18.839		17.807
231.0		19.736		18.608	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	17.167	17.543	17.486	17.581	16.950	17.290	17.758	17.655	17.269



Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

$$W/E/S = 192.870$$

$$P_{2A}/P_0 = 1.315$$

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 257.

CRUISE CONFIGURATION

100% EQUIVALENT REFORM SIZED

			WALL STATICS								
CIRC. LOC. DEG.	STATION 0 TIP	HUB	CIRC. LOC. DEG.	STATION 1 TIP	HUB	CIRC. LOC. DEG.	STATION 2 TIP	HUB	CIRC. LOC. DEG.	STATION 2A TIP	HUB
45	13.586	13.665	3	12.903		10	*	15.069	45	16.874	16.217
135	13.836	13.941	102	13.582	13.723	94.5	17.402	14.764	99	16.868	16.327
225	13.756	13.877	187.5	13.362		180	15.705	14.730	193.5	16.578	16.102
315	13.626	13.724	285.5	13.296	13.629	270	15.948	14.730	306	16.745	16.311

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
51	585.237	581.218	571.504	562.508	559.214
186	577.991	570.690	561.686	555.494	554.666
285	573.536	571.911	565.379	558.388	557.563
330					

## INLET TOTAL PRESSURE

STATION 0

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
9	14.087	14.143	14.133	14.110	14.149
99	14.695	14.703	14.706	14.709	14.720
189	14.706	14.709	14.712	14.700	14.700
279	14.690	14.703	14.701	14.707	14.711

## DISCHARGE TOTAL PRESSURE

STATION 2A

PERCENT SPAN FROM TIP

CIRC. LOC. DEG.	10	30	50	70	90
42.5	20.647	19.616	18.806	17.025	16.399
213.0	19.989		18.704		17.846
231.0		19.583		18.464	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	16.796	17.179	17.215	17.301	16.686	16.944	17.417	17.368	16.969

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

WTS = 6.2/32

Pa/Pb = 1.271

90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 260.

CRUISE CONFIGURATION

100 % EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.	STATION 0		CIRC. LOC. DEG.	STATION 1		WALL STATICS		CIRC. LOC. DEG.	STATION 2		CIRC. LOC. DEG.	STATION 2A	
	TIP	HUB		TIP	HUB				TIP	HUB		TIP	HUB
45	13.237	13.328	3	12.646				10	*	13.944	45	15.931	15.294
135	13.544	13.732	102	13.148	13.391			94.5	16.718	14.373	99	15.881	15.098
225	13.523	13.751	187.5	13.200				180	16.247	14.275	193.5	15.632	15.063
315	13.463	13.557	286.5	13.138	13.397			270	16.227	14.403	306	15.755	15.298

DISCHARGE TOTAL TEMPERATURE STATION 2A PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
51	553.707	560.508	554.078	548.007	546.788
186	560.909	554.078	548.818	542.302	543.120
285	556.494	555.689	552.059	544.752	542.711
330					

INLET TOTAL PRESSURE STATION 0 PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
9	13.906	14.006	13.996	13.967	13.996
99	14.587	14.691	14.695	14.705	14.718
189	14.706	14.710	14.708	14.702	14.687
279	14.679	14.691	14.690	14.702	14.702

DISCHARGE TOTAL PRESSURE STATION 2A PERCENT SPAN FROM TIP					
CIRC. LOC. DEG.	10	30	50	70	90
42.5	19.555	19.674	19.008	17.465	16.520
213.0	19.304		18.335		17.556
231.0		18.842		17.989	

* (DEGREES)	351	354	355.5	357	359	1.5	4	6	9
	15.952	16.295	16.346	16.408	15.956	16.109	16.522	16.460	16.068

Table B-2. Basic Distortion Data 90-Degree Circumferential Distortion (Continued)

 $W\sqrt{G}/S = 22.721$  $P_{2A}/P_{2B} = 1.223$ 

## 90 DEGREE CIRCUMFERENTIAL DISTORTION

POINT NUMBER 250.

## CRUISE CONFIGURATION

100 % EQUIVALENT ROTOR SPEED

CIRC. LOC. DEG.			WALL STATICS			CIRC. LOC. DEG.			CIRC. LOC. DEG.		
STATION 0			STATION 1			STATION 2			STATION 2A		
TIP	HUB		TIP	HUB		TIP	HUB		TIP	HUB	
45	12.998	13.125	3	12.414		10	*	13.191	45	14.664	13.961
135	13.514	13.628	102	12.983	13.196	94.5	15.894	13.816	99	14.627	13.617
225	13.482	13.635	187.5	13.061		180	15.635	13.759	193.5	14.412	13.735
315	13.317	13.407	286.5	12.959	13.213	270	15.484	13.940	306	14.509	13.913

## DISCHARGE TOTAL TEMPERATURE

STATION 2A

CIRC. LOC. DEG.		PERCENT SPAN FROM TIP				
		10	30	50	70	90
51	566.194	561.315	555.590	552.302	554.269	
185	560.500	557.229	552.713	546.517	546.517	
285	562.532	552.049	556.410	548.527	546.517	
330						

## INLET TOTAL PRESSURE

STATION 0

CIRC. LOC. DEG.		PERCENT SPAN FROM TIP				
		10	30	50	70	90
9	13.834	13.937	13.906	13.899	13.906	
99	14.630	14.706	14.708	14.714	14.717	
189	14.715	14.714	14.718	14.704	14.697	
279	14.682	14.697	14.596	14.708	14.706	

## DISCHARGE TOTAL PRESSURE

STATION 2A

CIRC. LOC. DEG.		PERCENT SPAN FROM TIP				
		10	30	50	70	90
42.5	18.470	17.681	17.282	16.776	16.083	
213.0	18.652		17.757		16.895	
231.0		13.131		17.393		

\* (DEGREES) 351 254 355.5 357 359 1.5 4 6 9

15.106 15.396 15.802 15.561 15.207 15.295 15.547 15.596 15.280

# APPENDIX C DERIVATION OF STALL MARGIN DEFINITION

The definition of the compressor stability or stall margin used herein is developed from continuity considerations. The model used for this development is comprised of a compressor stage and a flow restricting area downstream of the stage as shown schematically in figure C-1. At the flow restriction, the flow rate may be expressed as follows:

$$W = f_w (M_2) \times A_2 \times P_2 \times \frac{1}{\sqrt{T_2}} \quad (C-1)$$

where the quantity  $f_w (M_2) = \frac{W \sqrt{T_2}}{P_2 A_2}$ , a function of the local Mach number.

Expressing equation (C-1) in terms of the compressor inlet corrected air-flow yields

$$\frac{W \sqrt{\theta_1}}{\delta_1} = f_w (M_2) \times A_2 \times \frac{P_2}{P_1} \times \frac{1}{\sqrt{T_2/T_1}} \times \frac{2116}{\sqrt{518.6}} \quad (C-2)$$

$$\text{or} \quad \frac{\frac{P_2/P_1}{W \sqrt{\theta_1}}}{\delta_1} = \frac{\sqrt{T_2/T_1} \times \frac{\sqrt{518.6}}{2116}}{f_w (M_2) \times A_2} \quad (C-3)$$

This relationship may be depicted on the compressor map by considering the quantity on the right side of the equation to be the parameter as shown in figure C-2. The quantity  $\sqrt{T_2/T_1}$ , although clearly associated with the compressor, has been combined with the flow restriction associated quantities  $f_w (M_2)$  and  $A_2$  for simplicity. This measure is justified because the change in compressor pressure ratio,  $(P_2/P_1)$ , is much larger than the related change in the square root of the temperature ratio,  $(\sqrt{T_2/T_1})$ .

If the compressor, operating initially at point A in figure C-2, is caused to stall (point B) by changing the downstream flow restriction, the following equality may be written to express this change in operating point:

$$\frac{\left[ \frac{P_2/P_1}{W\sqrt{\theta_1}} \right]_B - \left[ \frac{P_2/P_1}{W\sqrt{\theta_1}} \right]_A}{\left[ \frac{P_2/P_1}{W\sqrt{\theta_1}} \right]_A} \times 100 = \frac{\left[ \frac{\sqrt{T_2/T_1}}{f_w(M_2) \times A_2} \right]_B - \left[ \frac{\sqrt{T_2/T_1}}{f_w(M_2) \times A_2} \right]_A}{\left[ \frac{\sqrt{T_2/T_1}}{f_w(M_2) \times A_2} \right]_A} \times 100$$

Thus, it may be noted that the percentage change in the flow restriction parameter required to change the compressor operating point from A to B, the stall limit, is equal to the percentage change in  $\left[ \frac{P_2/P_1}{W\sqrt{\theta_1}} \right]_{\delta_1}$  from A to B;

and this quantity is therefore defined as the compressor stability margin

$$\frac{\left[ \frac{P_2/P_1}{W\sqrt{\theta_1}} \right]_B - \left[ \frac{P_2/P_1}{W\sqrt{\theta_1}} \right]_A}{\left[ \frac{P_2/P_1}{W\sqrt{\theta_1}} \right]_A} \times 100 = SM$$

In the case of the compressor characteristic denoted by points A', C' and B' of figure C-2, it may be noted that the same change in flow restriction area and/or  $f_w(M_2)$  that causes the compressor operation to shift from point A to point B will cause a shift from point A' to point C' and will not cause instability. At this speed a further increase is required to force operation to shift to point B' and cause stall. Thus, the stability margin on this speed line (based on point A') is greater than that on the former speed line (based on point A). This comparison illustrates an important quality of this definition of stability margin, in that it provides a means of equating both flow range and pressure rise capability with regard to their stabilization of compressor operation.

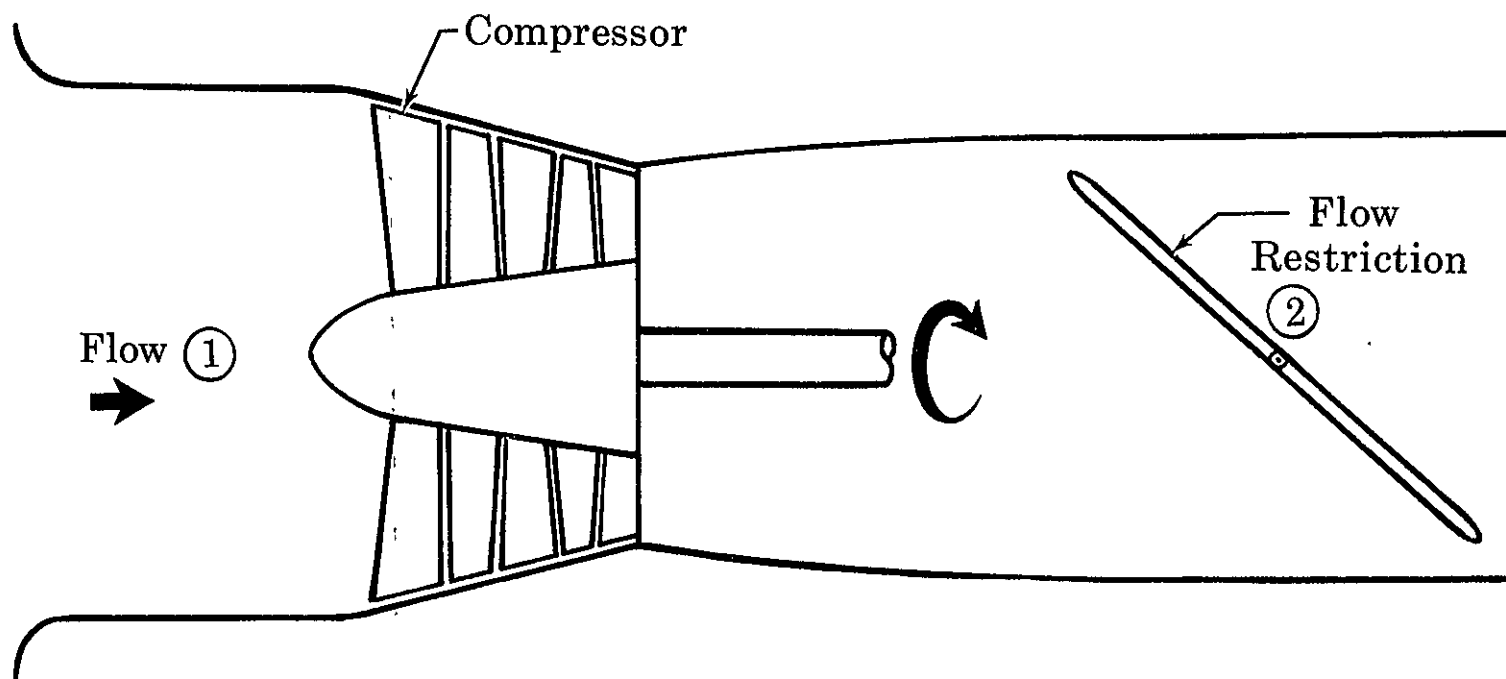


Figure C-1. Model for Defining Compressor Stability

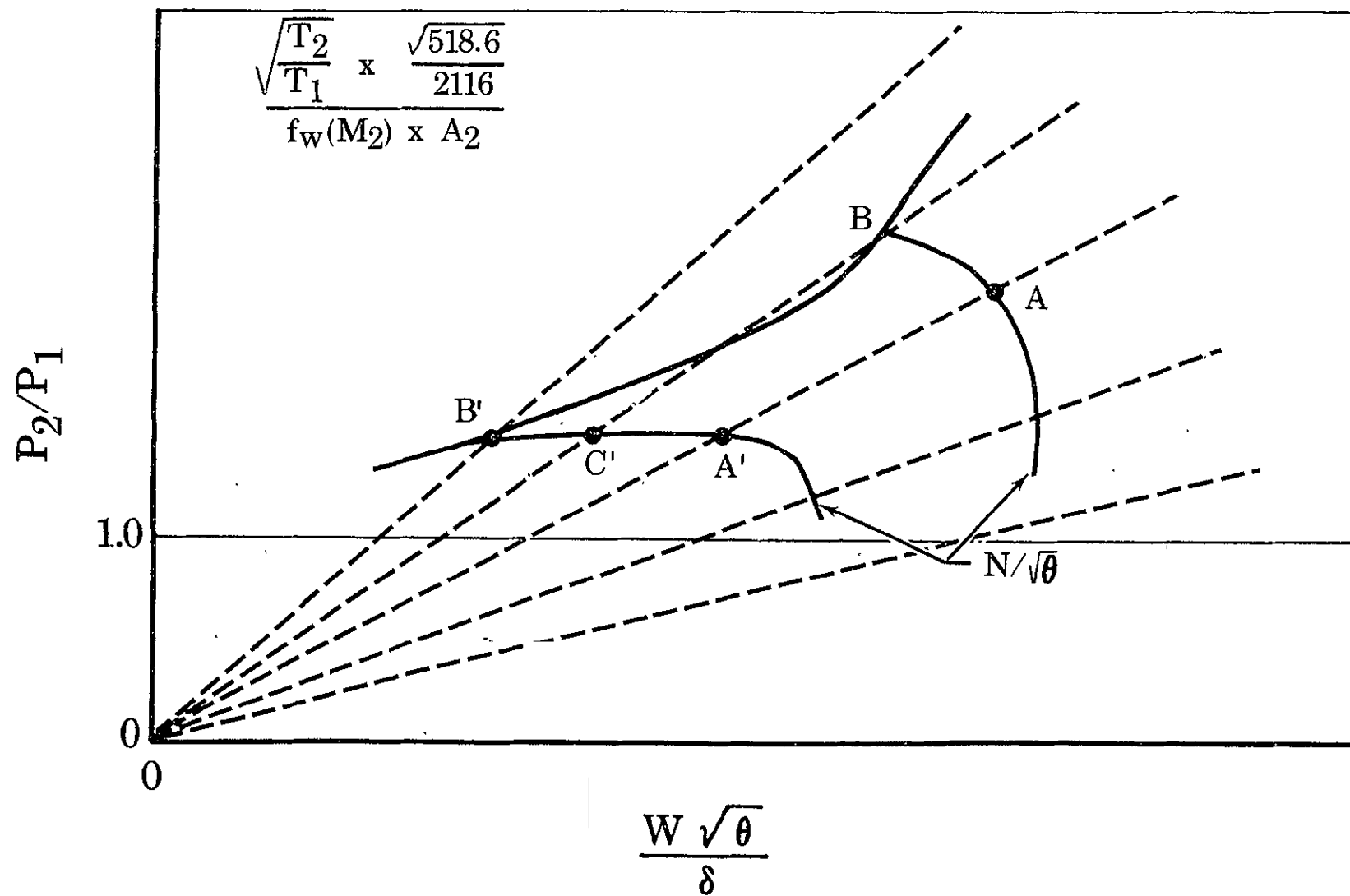


Figure C-2. Compressor Inlet Corrected Airflow

NAS3-7604  
REPORTS DISTRIBUTION LIST

1. NASA-Lewis Research Center  
21000 Brookpark Road  
Cleveland, Ohio 44135  
Attention:

Report Control Office	MS 5-5	1
Technical Utilization Office	MS 3-19	1
Library	MS 60-3	2
Fluid Systems Component		
Division	MS 5-3	1
Pump & Compressor Branch	MS 5-9	6
A. Ginsburg	MS 5-3	1
M. J. Hartmann	MS 5-9	1
W. A. Benser	MS 5-9	1
D. M. Sandercock	MS 5-9	1
L. J. Herrig	MS 5-9	1
T. F. Gelder	MS 5-9	1
C. L. Ball	MS 5-9	1
L. Reid	MS 5-9	1
J. H. De Ford	MS 77-3	2
S. Lieblein	MS 54-6	1
C. L. Meyer	MS 60-4	1
J. H. Povolny	MS 60-4	1
A. W. Goldstein	MS 7-1	1
J. J. Kramer	MS 7-1	1
W. L. Beede	MS 5-3	6
C. H. Voit	MS 5-3	1
J. H. Childs	MS 60-4	1

2. NASA Scientific and Technical Information Facility  
P. O. Box 33  
College Park, Maryland 20740  
Attention: NASA Representative

6

3. FAA Headquarters  
800 Independence Ave., S. W.  
Washington, D. C. 20553  
Attention:  
    Brig. General J. C. Maxwell  
    F. B. Howard

4. NASA Headquarters  
Washington, D. C. 20546  
Attention:  
    N. F. Rekos (RAP)